

BASEWIDE ENERGY SYSTEMS PLAN
HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

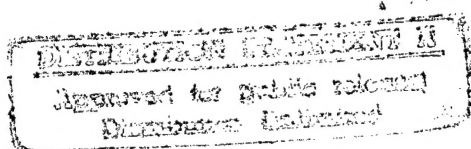
FINAL REPORT
EXECUTIVE SUMMARY

PREPARED FOR:

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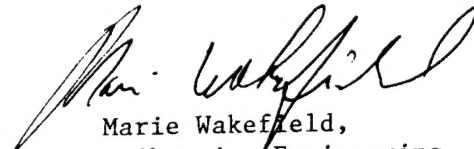


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1.0 PURPOSE

This document is the Executive Summary of the Basewide Energy Systems Plan for the Hawthorne Army Ammunition Plant (HWAAP) at Hawthorne, Nevada, prepared under Contract No. DACA05-81-C-0122, between the Department of the Army (Sacramento District), Corps of Engineers, and Chilton Engineering, Chartered. This project has been executed as a part of the Department of the Army's Energy Engineering Analysis Program (EEAP). The overall objective of the project is to develop a systematic plan of projects that will result in the reduction of energy consumption in compliance with the objectives set forth in the Army Facilities Energy Plan (AFEP), without decreasing the readiness posture of the Army.

The Hawthorne Army Ammunition Plant is a Government Owned and Contractor Operator (GOCO) Army facility. Consequently, any reference made in this document to the Energy Conservation Investment Program (ECIP) is directly analagous to Energy Conservation and Management (ECAM). The ECAM designation pertains specifically to GOCO Army installations. All Programming Documents for projects developed from this study reference ECAM wherever ECIP is called for.

The criteria utilized in performing this EEAP study is the Supplemental Scope of Work (SSOW) dated 21 January 1982 which includes the Scope of Work for Increments A, B, and G revised 8 January 1982. This SSOW has been further supplemented by the SSOW dated 4 January 1983. The SSOW dated 8 January 1982 includes the SOW for Increment F. The SSOW dated revised 29 June 1982 includes the SOW for Increment C. The SSOW dated 9 September 1982 includes the SOW for Increment E.

The increments of work are defined in the General Scope of Work as follows:

- Increment A: Projects involving modifying, improving, or retrofitting existing buildings.
- Increment B: Projects involving utilities, energy plants, and distribution systems.
- Increment C: Projects involving renewable energy resources.
- Increment E: Projects involving boiler plant centralization and conversion of existing boiler plants to solid fuel-firing capability.
- Increment F: Projects involving low cost energy conservation measures which can be implemented under Facilities Engineering funding authority.
- Increment G: Feasible energy savings developed in Increments A and B which do not qualify under ECIP/ECAM criteria.

The governing criteria for ECIP/ECAM projects and for performing economic analyses is the "Energy Conservation Investment Program (ECIP) Guidance", DAEN-MPO-U, 6 August 1982, revised 31 December 1982, except for projects developed in Increment C. Increment C project economic evaluations are performed in accordance with Engineering Technical Letter (ETL) 1110-3-332, Part II. The construction cost of ECIP/ECAM projects must be greater than \$200,000. It is assumed that all improvement projects will be awarded in FY 86 (midpoint of construction about October of FY 86, BOD about the beginning of FY 87). The Uniform Present Worth (UPW) discount factors utilized in the Savings to Investment Ratio (SIR) life cycle cost economic analysis are taken directly from Table 9 of the ECIP Guidance. Table 9 UPW discount factors are based upon a 7% discount rate and DOE projected fuel escalation rates for Region 9 which includes Hawthorne, Nevada. The maximum possible economic life for ECIP/ECAM projects is 15 years.

This Executive Summary and all Programming Documents (DD Form 1391 with detailed justifications, PDB I, and PDB II) fully comply with criteria and guidance documents described above. Note that due to issuance of the latest ECIP guidance after the Pre-Final Report Submittal, the Main Report and the Appendices have not been revised to reflect the new SIR economic procedures. Consequently, the Executive Summary and the Programming Documents take precedence over the Main Report (Volume I) and the Appendices (Volume II) of the Basewide Energy Systems Plan for Hawthorne Army Ammunition Plant.

The study methodology for the EEAP at the Hawthorne AAP is segmented into three phases of work. Phase I involves data gathering and field surveys. Phase II includes analysis of the data collected during the initial phase, identification of potential projects, feasibility and economic evaluations, and preparation of the first pages of DD Forms 1391, including support data. The procedure for identification of potential projects included use of Appendix C of the SOW, "Energy Conservation Opportunities". The final segment of the study methodology includes preparation of the DD Forms 1391, the Project Development Brochures (PDB's) and preparation of the final report document which presents the analysis, results, and recommendations of the study.

This Executive Summary specifically addresses the study results pertaining to the completion of the above project for Increments A, B, C, E, F, and G. The Final Report consists of all the data developed throughout the study, as well as all energy savings project developments and recommendations. The Final Report volume titles are delineated below for which this Executive Summary applies:

Volume I : Main Report, Increments A, B, C, & G
Volume II : Appendices, Increments A, B, C, & G
Volume III: Programming Documents
Volume IV : Increment E
Volume V : Increment F

The energy profile of the Hawthorne AAP, including current and historic energy use, is presented in Section 2.0 of this Executive Summary. Section 3.0 presents a summary of the results of the EEAP. The energy conservation projects analyzed, as well as the economic feasibility criteria of those projects, are presented. The predicted energy use reduction and compliance with AFEP goals are also discussed. The short term energy plan for the Hawthorne AAP is presented in Section 4.0.

The Executive Appendix of this document includes, for the reader's convenience, a complete Glossary of terms and abbreviations in Appendix A, a Reference list in Appendix B, the Scope of Work for this study in Appendix C, and the Building Master List in Appendix D.

2.0 INSTALLATION ENERGY PROFILE

The Hawthorne Army Ammunition Plant (HWAAP) is divided into two distinct areas. The Industrial Area contains the majority of the Base's administrative and maintenance facilities, as well as all of the housing and recreational facilities. The Ordnance Area contains the ammunitions storage and production areas. Space heating and process heat are provided by twelve (12) centralized, Diesel Fuel No. 2 (DF-2) fueled, steam generation plants, and two (2) hot water heating facilities. Two (2) steam plants are not in active use. Some space heating is accomplished with propane, the largest area of this use being the unaudited housing areas at Babbitt, Connelly, and Schweer. Evaporative cooling is widely utilized, with a small quantity of isolated mechanical cooling systems used in areas with computer and/or electronic equipment.

This section presents the current energy profile at Hawthorne AAP, as well as the historical energy use of the facility.

2.1 Current Energy Use

The FY 1980 basewide energy use at Hawthorne AAP is shown graphically in Figure 2.1.1. The three fuel types utilized at the Base include Diesel Fuel No. 2 (DF-2) or Fuel Oil No. 2, propane, and electricity, and are delineated by their respective end use components. This figure shows the energy use in percentage of the Fiscal Year 1980 (FY 80) basewide site energy consumption of 260,564 MBtu's (352,978 MBtu's source energy). Diesel Fuel No. 2 represents the majority (72.2%) of the basewide energy consumption, followed by electricity (14.9%), and propane (12.9%). The end use component breakdowns of these three fuel types have been further portrayed in Figure 2.1.2. In this Figure, the energy consumption of each fuel

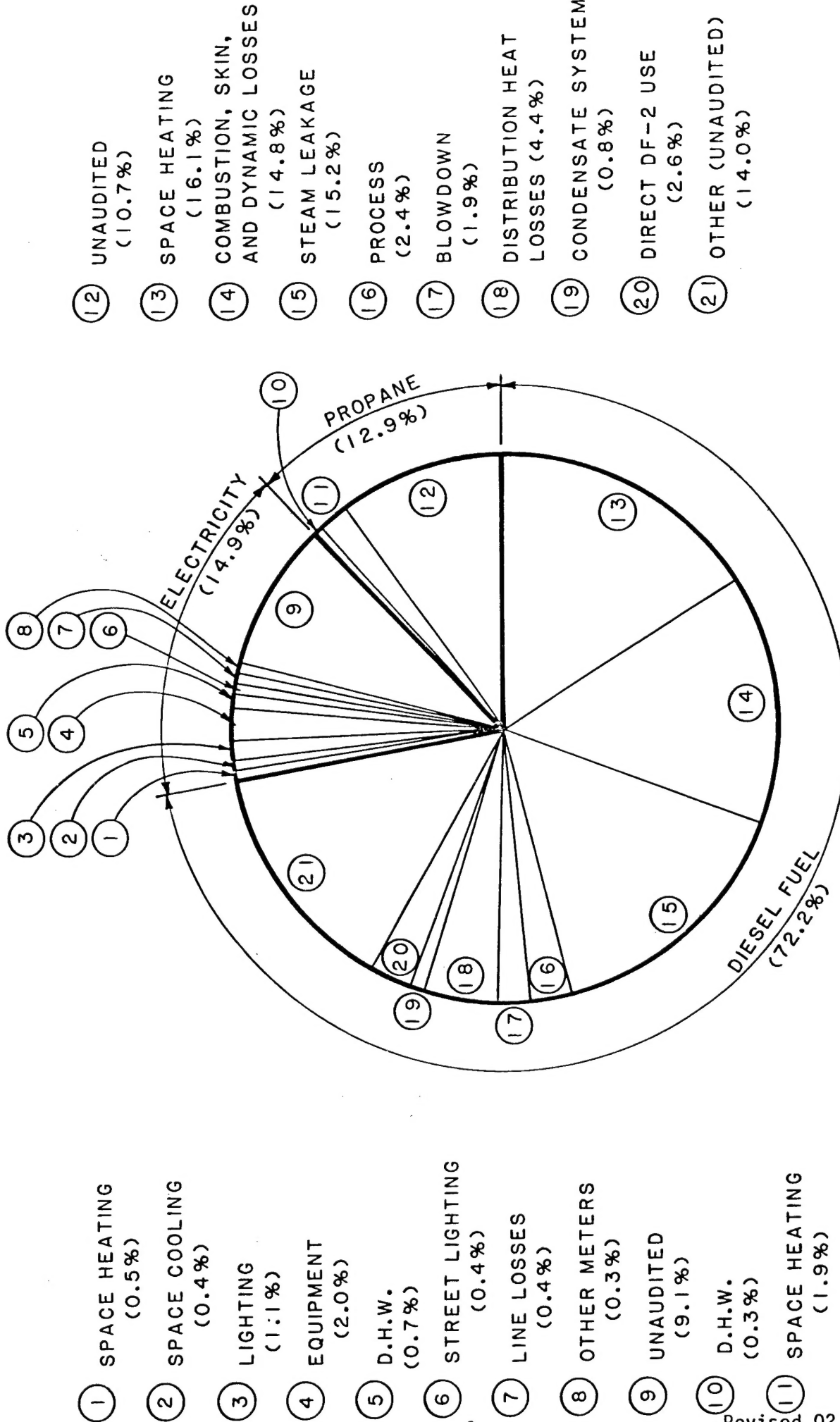


FIGURE 2.1.1 BASEWIDE ENERGY USE BY END USER

(260,564 MBTU SITE ENERGY)
(352,978 MBTU SOURCE ENERGY)

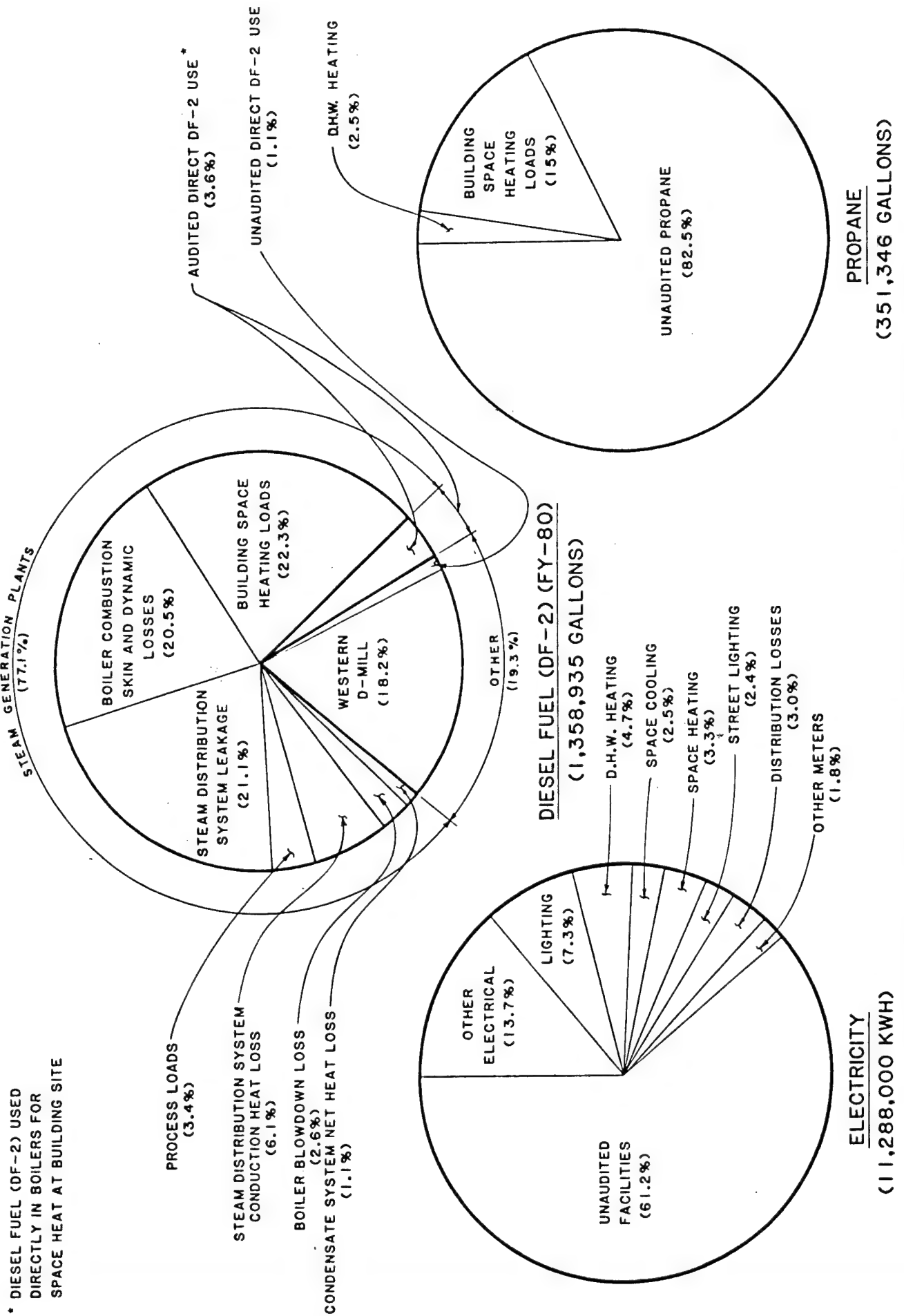


FIGURE 2.1.2 BASEWIDE ENERGY USE BY FUEL TYPE

type is shown in actual energy units (i.e., Gallons or Kilowatt-Hrs).

In addition, each fuel type has been graphically divided into its respective end use components as described above for Figure 2.1.1.

These results demonstrate the relative energy consumption of each end use component, thus indicating the appropriate areas of concern in the Energy Conservation And Management (ECAM) analysis. These areas of concern are listed for each fuel type below. The "unaudited" categories in Figure 2.1.1 represent the energy consumption of those facilities not included in the Scope of Work for this contract.

- Diesel Fuel No. 2: Combustion for steam production and the steam distribution elements account for 51.4% of the DF-2 consumption and are obvious areas for ECAM project investigation. In addition, building space loads account for 22.3% of the DF-2 consumption and are also potential ECAM project areas.
- Propane: Building space heating and Domestic Hot Water (DHW) heating account for 17.5% of the audited use and are areas for ECAM analysis.
- Electricity: Each facet of electrical consumption requires investigation for energy savings projects, since no one end-use component represents a substantial majority of the electrical consumption.

2.2 Historical Energy Use

Energy consumption at HWAAP has declined since the mid-1970's. This decline is shown in Table 2.2.1 for the six fiscal years from 1975 through 1980. Most of this reduction is attributable to a general reduction in plant personnel and facilities activities. However, some energy conservation measures have been implemented throughout these years and are partly responsible for the decline in energy consumption shown in Table 2.2.1.

TABLE 2.2.1 ANNUAL BASEWIDE ENERGY REDUCTION SINCE 1979

FISCAL YEAR	ELECTRICITY (MBTU)		DIESEL FUEL (MBTU) ^b	PROPANE (MBTU) ^c	TOTAL ENERGY (MBTU)		% REDUCTION SINCE FY '75	
	SITE ^a	SOURCE ^{a'}			SITE	SOURCE	SITE	SOURCE
1980	38,526	130,940	188,484	33,554	260,564	352,978	31.8	29.7
1979	41,192	140,000	263,093	31,665	335,950	434,758	12.1	13.5
1978	39,724	135,012	d	36,627	N/A	N/A	N/A	N/A
1977	44,874	152,517	d	46,456	N/A	N/A	N/A	N/A
1976	45,482	154,582	238,194	51,670	335,346	444,446	12.3	11.5
1975	50,130	170,381	267,670	64,395	382,195	502,446	N/A	N/A

a. 3,413 (BTU/KWH) a'. 11600 (BTU/KWH)

b. 138,700 (BTU/GAL)

c. 95,500 (BTU/GAL)

d. Usage data incomplete and considered unreliable.

3.0 ENERGY CONSERVATION PROJECTS

This section discusses the energy savings projects analyzed, as well as implementation recommendations for these projects. Also discussed are the projected basewide energy use reductions by the year 2000, as well as the anticipated annual energy use.

3.1 Energy Savings Projects Analyzed

The initial phase of this study involved field surveys of existing energy consuming facilities and systems. The purpose of the field surveys is to obtain the data required for determination and analysis of energy saving projects. A list of the facilities at the Hawthorne AAP which were subject to these surveys is located in Appendix D.

Analysis of the field survey data yields the basewide energy quantities discussed in Section 2.1, as well as candidate energy savings projects. These projects are developed within the various increments of work, as described in the Scope of Work (see Appendix C) for this study. Economic feasibility analyses are performed on these energy savings projects, and programming documents are developed for Increment A, B, and C projects which meet ECIP/ECAM criteria, and for the resulting Increment G projects. The programming documents (DD Form 1391 with Detailed Justifications and PDB-I) for these projects are contained in Volume III of the Basewide Energy System Plan for Hawthorne AAP.

Table 3.1.1 presents the ten energy savings projects for which programming documentation have been developed. These projects are ranked in order of decreasing Savings to Investment Ratios (SIR). The SIR is defined as the ratio of project Total Net Discounted Savings

TABLE 3.1.1
RANKED PROJECTS

<u>SIR ORDER</u>	<u>TEMP. PROJECT NO.</u>	<u>ECIP/ECAM PROJECT DESCRIPTION</u>	<u>INCREMENT OF WORK</u>	<u>SIR RATIO</u>
1	1	ECAM Project to Modernize Family Housing Building Envelopes	A	4.74
2	2	ECAM Project to Modernize Building Envelopes	A	3.13
3	3	ECAM Project to Modernize the Industrial Area Steam Distribution System	B	3.07
4	4	ECAM Project to Modernize Boiler Plant A13	B	2.78
5	10	ECAM Project for the Conversion of the Industrial Area to Geothermal Heating	C	2.25
6	5	ECAM Project to Modernize the Ordnance Area Steam Distribution System	B	1.47
7	6	ECAM Project to Modernize Condensate System for Boiler Plant A13	B	1.01
8	9	ECAM Project for the Hydroelectrical Development of Rose Creek	C	1.00
<u>Increment G Projects</u>				
9	7	Modernize Building Envelopes (Incr. G)	G	0.78
10	8	Modernize Boiler Plant Nos. 101-25 and 103-6 (Incr. G)	G	0.76

($\text{\$}$) to the project Total Investment ($\text{\$}$). Table 3.1.1 also includes each project's temporary project number. The projects are organized by this number in Volume III.

Table 3.1.2 lists all of the feasible projects analyzed as a result of this study. These projects include the six (6) Increment A and B ECIP/ECAM projects, the feasible Increment C ECIP/ECAM project, the feasible Increment C solar project, and the (totalized) Increment F projects. Included in this table are the energy savings, cost, and economic analysis results for each project. Note that the total energy savings and cost results are presented for the Increment F projects.

The following sections describe the energy savings projects evaluated during the EEAP for the Hawthorne AAP. Section 3.1.1 discusses the feasible ECIP/ECAM projects analyzed under Increment A. The feasible ECIP/ECAM projects analyzed under Increment B are described in Section 3.1.2. Note that all of the Increment A and Increment B projects are feasible and that programming documentation is complete for them. Section 3.1.3 describes the Increment C projects for which programming documentation have been developed, as well as feasible solar and other renewable energy projects analyzed under Increment C. The Increment E study is discussed in Section 3.1.4. Section 3.1.5 discusses the Increment F projects. The Increment G projects which resulted from Increments A and B analyses are described in Section 3.1.6. Projects which are recommended for further study are described in Section 3.1.7. Finally, Section 3.1.8 discusses the energy savings projects which were analyzed but were found to be infeasible.

TABLE 3.1.2
FEASIBLE PROJECT SUMMARY

PROJECT TITLE	TOTAL COST FY-86 (K\$)	SAVINGS		ECIP / ECAM ECONOMIC RESULTS		LIFE CYCLE COST RESULTS ^(B)	
		FIRST YEAR DOLLAR (\$)	ENERGY (SOURCE) (MBTU/YR)	SIR ^(A)	PAYBACK (YEARS)	CONVENTIONAL TOTAL LCC (\$)	ALTERNATE TOTAL LCC (\$)
INCREMENT A							
ECAM PROJECT TO MODERNIZE FAMILY HOUSING BUILDING ENVELOPES	16	4,860	818	4.74	3.16	N/A	N/A
ECAM PROJECT TO MODERNIZE BUILDING ENVELOPES	261	53,996	8,678	3.14	4.78	N/A	N/A
INCREMENT B							
ECAM PROJECT TO MODERNIZE INDUSTRIAL AREA STEAM DISTRIBUTION SYSTEM	952	197,241	28,503	3.07	4.88	N/A	N/A
ECAM PROJECT TO MODERNIZE BOILER PLANT A13	267	50,087	7,238	2.78	5.39	N/A	N/A
ECAM PROJECT TO MODERNIZE ORDNANCE AREA STEAM DISTRIBUTION AND CONDENSATE SYSTEMS	1603	167,963	18,086	1.47	10.19	N/A	N/A
ECAM PROJECT TO MODERNIZE THE CONDENSATE SYSTEM FOR BOILER PLANT A13	438	29,908	4,322	1.01	14.81	N/A	N/A
INCREMENT C							
ECAM PROJECT FOR THE CONVERSION OF THE INDUSTRIAL AREA TO GEOTHERMAL HEATING	4395	681,686	74,127 ^(C)	2.19	6.85	7,763,201	3,799,617
SOLAR POOL HEATING BUILDING A38	133	15,815	2,580	1.92 ^(E)	7.82 ^(E)	TOTAL LCC SAVINGS = ^(D) 88,947	
INCREMENT F							
TOTAL FOR ALL INCREMENT F PROJECTS	298 ^(F)	149,135	28,303	N/A ^(G)	N/A	N/A	N/A

^(A) Savings to Investment Ratio

^(B) Life Cycle Cost Analyses are completed as per ETL-1110-3-332, Part II, Paragraph 2 for the non-Solar Analyses, and ETL-1110-3-332, Part II, Paragraph 3 for the Solar Analyses.

^(C) This level of energy savings assumes implementation of the two (2) Increment A ECIP/ECAM projects to modernize building envelopes.

^(D) Total LCC Savings = (Conventional Total LCC - Solar Total LCC)

^(E) The SIR and Payback Values for Solar Projects are as determined by Life Cycle Cost Analysis.

^(F) 1982 Dollars

^(G) Energy to Cost Ratio (E/C) Analyses were performed for Increment F Projects. The average E/C is 193 MBtu/K\$.

All of the ECAM projects, as well as other feasible energy savings projects analyzed within this study, are described below.

3.1.1 Increment A Projects

The Increment A projects involve modifying, improving or retrofitting existing buildings, including family housing, to include architectural and structural features, HVAC systems, plumbing systems, interior or exterior building and parking facilities lighting. Building modifications that are applicable for Increment A analysis for the Hawthorne AAP include wall insulation, roof or ceiling insulation, floor insulation, glazing addition or windows, window weatherstripping, entrance door weatherstripping and loading dock door weatherstripping. Seven (7) types of wall insulation strategies are evaluated, eight (8) types of roof/ceiling insulation methods are considered, two (2) types of floor insulation, six (6) types of window weatherstripping, and three (3) levels of window insulation are evaluated. A detailed cost and method description of each of these envelope modifications is available in Appendix J of Volume II of the Basewide Energy Systems Plan for the Hawthorne AAP. The economic feasibility of each applicable building envelope modification is analyzed for each building under audit. The resulting feasible ECIP/ECAM projects are described below. Other modifications which are applicable but either relatively low in cost or infeasible are described in Section 3.1.5 as Increment F projects, or in Section 3.1.8 as projects which are considered but rejected.

- ECAM PROJECT TO MODERNIZE FAMILY HOUSING BUILDING ENVELOPES: Most of the heated family housing buildings at Hawthorne AAP have little or no roof/ceiling, and floor insulation. In addition, large air leakage cracks exist in doors. This situation causes high building heat loss rates, which causes high energy consumption to maintain allowed working temperatures/conditions. This project involves adding or increasing insulation (where applicable) in the building walls, floor, and roof. In addition, it involves weatherizing the doors with weatherstripping. This project pertains to Family Housing buildings only.
- ECAM PROJECT TO MODERNIZE BUILDING ENVELOPES: This project involves adding insulation to building envelopes, as well as weatherstripping doors and windows for the reasons described above. This project pertains to Non-Family Housing buildings only.

3.1.2 Increment B Projects

Increment B projects involve utilities and energy distribution systems, EMCS for building and distribution systems, and existing energy plants. Since the Hawthorne AAP has several central steam plants, the Increment B analysis concentrates on the modernization and modification of existing steam and condensate systems and boiler plants. Steam and condensate line modification analysis includes determination of the most economical level of pipe insulation, and consideration of condensate system expansion in Ordnance areas where no condensate return exists.

Boiler plant modernization includes separate economic analysis of four (4) different modifications. The resulting feasible Increment B ECIP/ECAM projects are described below. Application of an Energy Monitoring and Control System (EMCS) is also investigated. However, the simplistic nature of the energy consuming systems at the Hawthorne AAP does not provide adequate control opportunities to create energy and dollar savings large enough to support the cost of an EMCS. This portion of Increment B analysis is presented in detail in Section 7 of Volume I of the Basewide Energy Systems Plan for the Hawthorne AAP. Other modifications which have proven to be infeasible are discussed in Section 3.1.8.

- ECAM PROJECT TO MODERNIZE THE INDUSTRIAL AREA STEAM DISTRIBUTION SYSTEM: The steam distribution system in the Industrial Area of the HWAAP has deteriorated greatly. The insulation for the trenched underground piping has been badly damaged by exposure to inundation from irrigation water and the preinsulated, direct buried piping has deteriorated at connections to manholes. This situation results in a high occurrence of steam leakage and large amounts of energy wasted in distribution system conduction heat loss. The Industrial Area is served by Boiler Plant A13. This project involves replacing all direct buried piping, all pipe fittings and valves, and all pipe insulation with new material.

- ECAM PROJECT TO MODERNIZE BOILER PLANT A13: This project involves modifications to boiler controls and operating systems that will result in significant savings of Diesel Fuel No. 2 (DF-2) at Plant A13. Modifications include O_2 trim controls for proper combustion air and fuel flow modulation, heat recovery from stack gas to preheat boiler feedwater flows, the installation of stack dampers to prevent infiltration of ambient air during unfired boiler standby operating periods, and lead/lag controls to improve the dynamic efficiency of boilers when operated in a primary/secondary relationship.
- ECAM PROJECT TO MODERNIZE ORDNANCE AREA STEAM DISTRIBUTION AND CONDENSATE SYSTEMS: This project involves modernization of the Ordnance Area steam distribution systems served by Plant Nos. 101-25, 102-31, 103-6, 104-2, and 104-4, as described above for the modernization of the Industrial Area steam distribution systems. In addition, the existing condensate systems in the Ordnance Area are badly deteriorated and in need of refurbishment (except for Plant Nos. 103-31 and 101-42, whose condensate systems were completely replaced in 1977). Replacement of leaking condensate piping and fittings will result in more condensate returned to the boiler plants which will result in energy savings, as well as reductions in makeup water treatment costs and system maintenance costs. The

boiler plant condensate systems considered for this project (except for the two plants mentioned above) are as follows: 101-25, 102-31, 103-6, 104-2, and 104-4.

- ECAM PROJECT TO MODERNIZE THE CONDENSATE SYSTEM FOR PLANT A13: The existing condensate return system for Plant A13 (Industrial Area) at the HWAAP is badly deteriorated due to corrosion and is incomplete, requiring condensate dumping to grade. These conditions result in a loss of energy from the Industrial Area heating system. Replacement with a new complete condensate return system will result in energy saved, as well as a reduction in makeup water treatment costs and system maintenance costs.

3.1.3 Increment C Projects

Increment C projects involve renewable energy projects, principally solar and biomass. Renewable energy sources include biomass, hydro, wind, solar, tide, and wave propagation. The feasibility of utilizing solar or biomass for space heating, space cooling, Domestic Hot Water (DHW) or process heat, or combinations thereof are investigated. Geothermal and nuclear sources, although not strictly renewable energy sources, are also considered. Since the Hawthorne, Nevada area is geothermally active, the feasibility of utilizing a potential geothermal resource in the Industrial Area is evaluated and is highly recommended. The economic limits for geothermal resource locations in the Ordnance Area are investigated. The results of this evaluation are located in Increment C - Option 3 of the Basewide Energy

Systems Plan (a separately bound report) for the Hawthorne AAP. Section 3.1.3.1 describes the feasible solar energy project developed under this increment of the study. The Increment C projects for which programming documentation have been developed are described below. Applications of renewable energy sources which are recommended for further study are described in Section 3.1.7. Other applications of renewable energy which are not feasible are presented in Section 3.1.8.

- ECAM PROJECT FOR THE CONVERSION OF THE INDUSTRIAL AREA TO GEOTHERMAL HEATING: The existing Industrial Area heating system uses a depletable fossil fuel (DF-2) and has major deficiencies in combustion (inadequate boiler controls), steam supply (deteriorated insulation and leaking pipes), and condensate return (incomplete system). Installation of a geothermal heating system would displace all of the present DF-2 consumption of the Industrial Area, as well as replace the existing deteriorated steam equipment, both subloop distribution and building, with new hydronic equipment. The existing primary steam distribution system is left intact to provide backup in the event of geothermal system malfunction. However, if the geothermal project is implemented, the steam system and the A13 boiler plant modifications are unnecessary, and in fact, are not economical. Implementation of this project is highly recommended due to the large energy savings and the self-sufficiency it offers to the Hawthorne AAP.

- ECAM PROJECT FOR HYDROELECTRIC DEVELOPMENT OF ROSE CREEK: This project is economically feasible under SIR ECIP/ECAM criteria, with an SIR value of 1.0 (actual SIR is 0.996, which is rounded to 1.00). However, the total Life Cycle Cost (LCC) of the Alternate System is greater (\$499) than the total LCC of the Conventional System, rendering this project infeasible based on LCC criteria. Since programming documentation is complete, this project is presented as an Increment C ECIP/ECAM project. However, based on LCC criteria, this project is not recommended. This project involves developing the hydroelectric potential of Rose Creek. The proposed new construction will involve a powerhouse structure, penstock, and the installation of power generation equipment, power transmission lines, and transformer/utility interconnection equipment. The electrical power production from this project will be purchased by Sierra Pacific Power Co. (SPPCo) at the current Public Utilities Regulatory Policy Act (PURPA) power purchase rate.

3.1.3.1 Feasible Solar Energy Projects

The following project has been analyzed under Increment C criteria. This project complies with Life Cycle Cost criteria, as per ETL 1110-3-332, Part II, Paragraph 3.

- SOLAR POOL HEATING RETROFIT OF BUILDING A38: This project involves retrofitting the existing pool steam heating system to include solar energy heating.

3.1.3.2 Increment C - Option 3: Ordnance Area Geothermal

The purpose of Increment C - Option 3 is to investigate the potential for the conversion of the Ordnance Area (Hawthorne AAP) steam heating systems to geothermal heating. The analysis of this potential involves the location of boiler plants and distribution systems to be displaced by geothermal space heating in conjunction with establishing economic limits for the reconnaissance area for geothermal resource investigation. This analysis develops economic results for the geothermal conversion of two selected boiler plants (Plant Nos. 101-25 and 103-6), assuming the geothermal well head facilities can be located within the building areas (within a one mile radius) served by each of the two plants. Based upon the above results, economic limits for the geothermal resource locations are established.

This initial feasibility analysis consists of preliminary well head facility, primary and secondary distribution systems, disposal system, and building systems design. Cost estimates are formulated for Plant Nos. 101-25 (101 Area) and 103-6 (103/108 Area), assuming that the location of a geothermal resource is within a one mile radius (approximately 3 square mile area) of each of the plants (i.e., a separate analysis is conducted for each plant). Economic analyses are conducted for several options based upon Life Cycle Cost (LCC) analysis procedures and Engineering Technical Letter (ETL) 1110-3-332, dated 22 March 1982. Due to the low operational levels of the facility, the total LCC is calculated for each plant under present use conditions and under full use conditions. The LCC of

each option for each plant is compared to the LCC of the conventional steam heating system, based upon a fifteen year economic life, to determine economic feasibility.

Table 3.1.2.1 shows the results of the economic analyses for the options studied.

TABLE 3.1.2.1
ORDNANCE AREA GEOTHERMAL FEASIBILITY

GEOTHERMAL CONVERSION PROJECT	INITIAL INVESTMENT	TOTAL LCC	LIFE CYCLE SAVINGS
101 AREA:			
<u>Conventional</u>			
Present Use	\$ 0	\$2,611,511	N/A
Full Use	\$ 0	\$7,436,987	N/A
<u>Geothermal</u>			
3 Sq. Mi. (Present Use)	\$2,336,934	\$2,583,817	+\$ 27,694
3 Sq. Mi. (Full Use)	\$2,336,934	\$2,964,191	+\$4,472,796
103/108 AREA:			
<u>Conventional</u>			
Present Use	\$ 0	\$3,217,057	N/A
Full Use	\$ 0	\$6,361,839	N/A
<u>Geothermal</u>			
3 Sq. Mi. (Present Use)	\$2,986,379	\$3,349,541	-\$ 132,484
3 Sq. Mi. (Full Use)	\$2,986,379	\$3,450,110	+\$2,911,729

These results show marginal feasibility for the 101 Area under present use with the geothermal system showing a total LCC of only \$27,964 less than the conventional system. The 103/108 Area under present use exhibits a total LCC which is greater

than its comparable conventional system by an amount equal to \$132,484, and is consequently not feasible. Under full use conditions, both geothermal systems show excellent feasibility.

The initial recommendation of the Increment C - Option 3 study is to defer geothermal reconnaissance of the Ordnance Area until the Base substantially increases its activity levels. Note that the final results of this study will be documented with the results of the Well Drilling Program for the Industrial Area (Increment C - Option 2) in Volume VI, Further Geothermal Investigations. The final recommendations for Increment C - Option 3 will be presented in this new volume of the Basewide Energy Systems Plan.

3.1.4 Increment E Projects

The Increment E portion of the Basewide Energy Systems Plan for the Hawthorne AAP evaluates the economic feasibility of both centralization of boiler plants and conversion of existing steam generation facilities to coal-firing capabilities. The use of other solid fuels is also investigated.

The feasibility analysis of boiler plant consolidation involves the development of four centralization options. Option I requires the construction of a new central plant, which would serve the Ordnance Area. Option II serves the Ordnance Area from two central plants, utilizing existing structures and two existing boilers. Option III serves the Ordnance Area from three central plants, utilizing three existing structures and five existing boilers. Option IV is the "do nothing" alternative, serving the Ordnance Area from the existing plant configuration.

The feasibility analysis of boiler plant consolidation also involves detailed plant load analysis using the DOE 2.1A computer program and detailed cost estimates for each of the centralization options, including initial capital costs and annual maintenance costs. Finally, the net Life Cycle Cost (LCC) is calculated for each centralization option.

The results of the economic analyses for boiler plant centralization are presented in detail in Volume IV of the Basewide Energy Systems Plan for the Hawthorne AAP. The option with the least LCC, therefore the most economical option, is Option IV, which shows a present worth of net LCC of \$6,598,232. Option III shows the next lowest net LCC of \$10,755,132. Options II and

IA show net LCC's of \$13,711,413 and \$17,452,823, respectively. Based upon the least net LCC, Option IV, the existing plant configuration, is the most economical approach to centralization.

The conclusion that further boiler plant centralization at the Hawthorne AAP is uneconomical stems from two factors. First, an increase in energy usage results from centralization due to the additional steam distribution piping required to connect the existing steam distribution systems to the central plants. This energy increase is not offset by the energy savings realized by centralization. Secondly, boiler plant consolidation requires a large capital expenditure for implementation, as well as increased piping maintenance costs. Even though major boiler maintenance costs are larger in Option IV, they are not enough to offset the other fuel cost, capital cost, and operation/maintenance cost penalties.

The feasibility analysis of coal conversion considers the Ordnance Area's two largest boiler plants, Nos. 101-25 and 103-6, since the savings associated with conversion to coal is directly related to the level of fuel usage. The evaluation of coal conversion includes an assessment of the applicability and availability of coal technologies, utilization of the plant loads developed in the centralization study by the DOE 2.1A computer program, an engineering cost estimation of the equipment and labor requirements for coal conversion, and the calculation of the net LCC for converted and existing Plant Nos. 101-25 and 103-6.

The results of the economic analysis of coal conversion at Plant Nos. 101-25 and 103-6 are presented in detail in Volume IV of the Basewide Energy Systems Plan for the Hawthorne AAP. In both cases, the existing oil-fired plant has the least LCC. In the case of Plant No. 101-25, the net LCC of the existing oil-fired plant is \$3,530,064, and the LCC of the coal converted plant is \$4,925,647. For Plant No. 103-6, the net LCC of the existing plant is \$3,761,488 and the net LCC of the converted plant is \$5,351,767.

The conclusion that coal conversion is uneconomical at the Hawthorne AAP results from the high level of conversion costs relative to the fuel cost savings. The reduction in annual fuel expense does not offset the high capital investment and increased maintenance costs associated with coal conversion.

Based upon the economic analyses performed as a course of this Increment E study, it is recommended that no modifications be made to the existing Ordnance Area boiler plant arrangement. In addition, it is recommended that DF-2 remain the primary fuel used for steam generation at the Hawthorne AAP.

A detailed description of the applicable system is available in Section 3.2.3 of Volume I of the Basewide Energy Systems Plan for Hawthorne AAP.

3.1.5 Increment F Projects

The purpose of Increment F work is to provide recommendations for modifications and changes in system operation which are within Facilities Engineering (FE) funding authority and management control. Increment F projects may also be those

which are singular in application, thereby rendering them low in cost in relation to Increment A or B projects. Increment F projects are generally simplistic in nature, and, in most cases, the FE labor pool may be utilized for implementation. These projects are important to FE in that they are applicable for immediate implementation, thereby assisting the Base in meeting the FY 2000 energy use reduction goals.

The Increment F (Volume V) portion of the Basewide Energy Systems Plan for the Hawthorne AAP provides a list of 33 low or no cost energy saving projects, including energy and dollar savings, material and labor costs, and manhour requirements for each facility within each project. The list of these projects, and an indication of the number of buildings involved in each, is provided in Table 3.1.3.

Also provided in the Increment F study for the HWAAP is information pertaining to additional personnel training in the areas of boiler plant operation, maintenance and tuning, HVAC control systems operation and maintenance, and utilities rate management and energy use monitoring. Section 5.0 of Volume V of the Basewide Energy Systems Plan for the Hawthorne AAP provides information concerning one available seminar in boiler control and maintenance, five courses concerning HVAC controls, five courses in energy conservation, and courses in solar system and geothermal system operation and maintenance. Other general references concerning these areas of education are also provided.

TABLE 3.1.3
SUMMARY OF INCREMENT F PROJECTS

PROJECT TITLE	NO. OF BLDGS
Lower DHW Supply Temperature (Non-Family Housing)	29
Lower DHW Supply Temperature (Family Housing)	21
Install Timeclocks and Freeze Protection Control	12
Install Night Setback Thermostats	11
Relocate Steam Valve	1
Reduce Ventilation Air	1
Install Shower and Sink Restrictors	36
Turn Off DHW During Summer	17
Install Freeze Protection to Back Portion of Building	1
Install Thermostats	2
Add Insulation to DHW Tank (Non-Family Housing)	43
System Adjustments In Mechanically Cooled Buildings	5
Turn Off Propane Space Heaters During the Summer	12
Replace Incandescent Lighting	43
Cover Evaporative Coolers During the Winter	53
Install Aquastat on Domestic Hot Water System	1
Install Dampers on Exhaust Fans	3
Add Insulation to DHW Tank (Family Housing)	32
Install Thermostats on Evaporative Coolers in Active Buildings	39
Insulate DHW Supply Piping	1
Retrofit Vestibules	3
Replace Fan Type Air Curtains With Traffic Doors	1
Install Thermostats on Evaporative Coolers in Inactive Bldgs	1
Replace Kitchen Lights (Non-Family Housing)	2
Replace Kitchen Lights (Family Housing)	26
Replace Gas Pilot Lights With Electronic Ignition	12
Install Thermostats on Evaporative Coolers in Family Housing	24
Replace Large Air Handling System With Evaporative Coolers	1
Install/Repair Thermostatic Valves in Radiators	50
Economizer Cooling System Retrofit	6
Install Flue Dampers in Gas Fired DHW Tank Stacks	2
Decentralize Domestic Hot Water Distribution	2
Install Flue Dampers in Gas Space Heaters	13
Install Solar Film	2

The Increment F study also provides information concerning expendable equipment replacement. This deals with the replacement of existing equipment which has failed, or for some other reason, requires replacement, with more energy efficient devices now available. Electric motors, water heaters, propane unit heaters, vented propane room heaters, high efficiency fluorescent lights and ballasts, and air cooled condensers are addressed. The initial costs and operating of high efficiency units are compared with that of standard equipment. Three manufacturers that handle high efficiency units are provided for each type of equipment.

3.1.6 Increment G Projects

Increment G projects are those technically feasible energy saving projects developed in Increments A and B which do not qualify under the ECIP/ECAM economic criteria. There are two Increment G projects resulting from Increments A and B work for the Hawthorne AAP. Programming documentation is available for both of each projects in Volume III of the Basewide Energy Systems Plan for HWAAP. It is important to note that the Increment G project documentation contains all backup data and information required for future updating of the economic evaluations. The two Increment G projects are described below.

- ECAM PROJECT TO MODERNIZE BUILDING ENVELOPES (INCR. G):
This project involves adding insulation to building envelopes, as well as weatherstripping doors and windows for the reasons described in the Increment A building envelope modernization projects.

- ECAM PROJECT TO MODERNIZE BOILER PLANTS 101-25 AND 103-6 (INCR. G): This project involves modifications to boiler controls and operating systems that will result in significant savings of Diesel Fuel No. 2 (DF-2) at Plants 101-25 and 103-6. Modifications include O_2 trim controls for proper combustion air and fuel flow modulation, heat recovery from stack gas to preheat boiler feedwater flows, the installation of stack dampers to prevent infiltration of ambient air during unfired boiler standby operating periods, and lead/lag controls to improve the dynamic efficiency of boilers when operated in a primary/secondary relationship.

3.1.7 Projects Recommended For Further Study

The following projects are recommended for further study due to insufficient data available and the level of effort required to complete detailed analyses.

- CULTIVATION OF RUSSIAN THISTLE FOR BIOMASS FUEL PRODUCTION: Favorable results have been reported for the cultivation of Russian Thistle for Biomass Fuel Production (Ref: "The Feasibility of Commercialization of Russian Thistle *Salsola kali* L. As A Fuel Source", Karpiscak, et al., University of Arizona, 1981). However, further study would be required to determine the feasibility of this application, especially in regard to irrigation and soil requirements for thistle cultivation at the Hawthorne AAP.

- UTILIZATION OF WIND ENERGY: This project involves the production of electrical power from wind energy. However, due to insufficient wind data for HWAAP, this project cannot be evaluated at the present time. A wind monitoring program is recommended.

3.1.8 Projects Considered But Rejected

The following projects were considered in this study, but were found to be infeasible due to poor energy savings and/or economic results. These projects are organized by increment of work, however, there are no considered but rejected projects in Increment A.

Increment B: (Utilities, Energy Plants, Distribution)

- Energy Monitoring and Control System (EMCS)
- Install Condensate to All Outer Production Facilities, Plant No. 101-25
- Water Distribution System Projects
- Sewage Collection/Treatment Systems Projects

Increment C: (Renewable Energy Sources)

- Solar DHW for Family Housing
- Solar DHW for Barracks (A4, A396)
- Solar DHW for Decontamination Facilities (101-40, 103-39, 108-22)
- Solar DHW (Only) for A38
- Solar Space Heat for A396
- Solar Combination Space Heat and DHW for A396
- Solar Combination DHW and Pool Heat for A38

- Solar for Process Steam Generation, Plant No. 101-44
- Hydroelectric Development of Cottonwood Creek

Increment E: (Section 3.1.4)

- Boiler Plant Centralization in the Ordnance Area
- Conversion to Coal, Plant Nos. 103-6 and 101-25

Increment F: (Low or No Cost Energy Savings Measures. Also Projects Which Are Singular In Application)

- Heat Recovery System, Buildings A26 and 102-51
- Night Setback Control, Loading Docks
- Reduction of Lighting Levels
- Night Setback Control, Buildings 104-1 and 104-14
- Indirect/Direct Evaporative Cooling
- Heat Recovery From Refrigeration Systems, Bldgs A4 & A396
- Improve Window U-Values
- Window Area Reduction
- Prevent Air Stratification
- Utilization of a More Efficient Lighting Source
- Water Tube Boiler Projects
- Chiller Projects

3.2 Matrix of Actions and Savings

The implementation of feasible projects identified in this study involves the determination of duplicative efforts. The utilization of geothermal energy in the Industrial Area is duplicative in nature with respect to the Industrial Area steam system modernization ECIP/ECAM project, the Industrial Area condensate system modernization project, the Boiler Plant A13 modernization project, and the feasible solar retrofit project. Implementation of the geothermal conversion project will preclude the need to renovate the steam and condensate systems

and Plant A13 (the steam system would still be available for emergency backup), and will supply all of the hot water needs of the Industrial Area.

Due to this duplicative nature of the projects feasible for implementation, two distinct options have been developed. The geothermal option includes the ECIP/ECAM project to develop the geothermal resource in the Industrial Area, two envelope modification projects, and the ECIP/ECAM project to modernize the Ordnance Area steam and condensate systems. The Conventional option includes modernization of the conventional steam heating system in the Industrial Area in lieu of the geothermal project, as well as the other recommended projects in the Geothermal option. The projects involved in each of these options are shown in Table 3.2.1.

Of the two options described above, the Geothermal Option is the recommended course of action. The geothermal conversion project displaces the most fossil fuel of any project and realizes better economic results than its alternatives (See: "Conclusions and Recommendations, Basewide Energy Systems Plan, Hawthorne Army Ammunition Plant, Hawthorne, Nevada, Final Report). However, the implementation of the geothermal conversion project is dependent upon several assumptions. The most important of these assumptions is the realization of a geothermal production well that will meet the design requirements of the geothermal system. Another assumption is the successful location and construction of the geothermal effluent infiltration/percolation pond. Also, all legal and institutional barriers (i.e., permits) for this project must be satisfied before implementation. Therefore, before the geothermal conversion project can be implemented, the

TABLE 3.2.1 MATRIX OF ENERGY SAVINGS ACTIONS

ENERGY SAVINGS PROJECT	INCREMENT OF WORK	ECIP/ECAM PROJECT (YES/NO)	TOTAL COST (FY-86) (K\$)	SAVINGS	
				FIRST YEAR DOLLAR (\$/YR)	ENERGY* (MBTU/YR)
GEOTHERMAL CONVERSION OPTION					
ECAM PROJECT TO MODERNIZE FAMILY HOUSING BUILDING ENVELOPES	A	YES	16	4,860	818
ECAM PROJECT TO MODERNIZE BUILDING ENVELOPES	A	YES	261	53,996	8,678
ECAM PROJECT TO MODERNIZE ORDINANCE AREA STEAM DISTRIBUTION AND CONDENSATE SYSTEMS	B	YES	1,603	167,963	18,086
ECAM PROJECT FOR THE CONVERSION OF THE INDUSTRIAL AREA TO GEOTHERMAL HEATING	C	YES	4,395	681,686**	74,127**
INCREMENT F PROJECTS	F	NO	298***	149,135	28,303
TOTAL			6,573	1,057,640	130,012
CONVENTIONAL STEAM SYSTEM AND SOLAR RETROFIT OPTION					
ECAM PROJECT TO MODERNIZE FAMILY HOUSING BUILDING ENVELOPES	A	YES	16	4,860	818
ECAM PROJECT TO MODERNIZE BUILDING ENVELOPES	A	YES	261	53,996	8,678
ECAM PROJECT TO MODERNIZE INDUSTRIAL AREA STEAM DISTRIBUTION SYSTEM	B	YES	952	197,241	28,503
ECAM PROJECT TO MODERNIZE BOILER PLANT A13	B	YES	267	50,087	7,238
ECAM PROJECT TO MODERNIZE ORDINANCE AREA STEAM DISTRIBUTION AND CONDENSATE SYSTEMS	B	YES	1,603	167,963	18,086
ECAM PROJECT TO MODERNIZE THE CONDENSATE SYSTEM FOR BOILER PLANT A13	B	YES	438	29,908	4,322
SOLAR POOL HEAT-A38	C	NO	133	15,815	2,580
INCREMENT F PROJECTS	F	NO	298***	149,135	28,303
TOTAL			3,968	669,005	98,528

* ENERGY VALUES REPRESENT SOURCE ENERGY

** THESE VALUES REPRESENT THE SAVINGS FOR THE GEOTHERMAL SYSTEM AFTER THE BUILDING ENVELOPE MODERNIZATION PROJECTS HAVE BEEN IMPLEMENTED. BEFORE THE ENVELOPE MODERNIZATION, THESE VALUES ARE: (700,758 \$/YR & 76,883 MBTU/YR)

*** 1982 DOLLARS

location and development of a geothermal production well must be initiated. Also, all necessary permits for the geothermal fluid disposal system and production well must be satisfied. In the event that any of the above requirements cannot be satisfied, the implementation of the Conventional Steam System and Solar Retrofit Option should be implemented.

The annual energy and first year cost savings for the two project implementation options described above are summarized in Table 3.2.1. These savings are: 130,012 MBtu/Yr Energy Savings and a first year cost savings of \$1,057,640 for the Geothermal Option, and 98,528 MBtu/Yr Energy Savings and a first year cost savings of \$669,005 for the Conventional Steam System Option.

3.3 Energy Use Reductions By the Year 2000 and Anticipated Energy Use

The HWAAP basewide energy use has been reduced by 29.7% of FY 75's energy consumption as of FY 80 (see Table 2.2.1). This energy reduction results from a general reduction in facilities activity, as well as from the previous implementation of energy saving projects. Therefore, the AFEP goal of reducing annual basewide energy consumption by 25% of the FY 75 energy consumption by FY 85 has already been satisfied. In addition to this, some steam system renovation has been implemented by the Base in the Ordnance Area. The projected energy savings of the Ordnance Area Steam and Condensate ECAM Project has been modified to reflect this. However, the energy savings realized by Base-implemented renovation is included in energy use reductions.

Since the implementation date of the ECIP/ECAM projects presented in this report is FY 86, the AFEP goals applicable to the Basewide Energy Systems Plan are those set for FY 2000. The AFEP FY 2000 goals

are a 50% reduction in basewide total energy use, and a 75% reduction in basewide fossil fuel usage. The compliance of the two project implementation options previously described with the FY 2000 goals are summarized in Table 3.3.1. As shown, the Geothermal Option exceeds the total energy consumption goal by achieving an overall energy reduction of 55.4% after implementation. The Conventional Option does not meet this goal, since it achieves only a 49.2% reduction. Neither option meets the goal of a 75% reduction in fossil fuel usage. The Geothermal Option achieves a 71.4% reduction in fossil fuels and the Conventional Option achieves 61.3%. This may be due to the fact that the family housing facilities of Babbitt, Connelly, and Schweer, which were not subject to audit, are all heated with propane. This usage, which is not affected by the energy savings achievable by either option, combined with the heating and process loads of the Ordnance Area, cannot be further reduced by feasible ECIP/ECAM projects at this time. However, since the assumed date of construction for all ECIP/ECAM projects is FY 86, it is clear that more time is available to further reduce basewide energy consumption to meet the AFEP goals. It is likely that these further reductions will be possible as energy costs escalate, thus making the Increment G projects, or other possible projects, cost effective.

Finally, the projected annual energy consumption of HWAAP after implementation of the two options described above are: 213,724 MBtu/Year for the Geothermal Conversion Option and 245,208 MBtu/Yr for the Conventional Steam System and Solar Retrofit Option. These energy use values represent source energy quantities, and include the reduction in Ordnance Area DF-2 consumption due to the previously mentioned Base renovation work.

TABLE 3.3.1
PROPOSED PROJECTS - COMPLIANCE WITH AFEP GOALS

AFEP GOAL	PROJECTED ENERGY REDUCTIONS
GEOHERMAL CONVERSION OPTION COMPLIANCE WITH YEAR 2000 AFEP GOALS	
Reduce Basewide Energy Consumption By 50%	55.4%
Reduce Basewide Fossil Fuel Consumption By 75%	71.4%
CONVENTIONAL STEAM SYSTEM AND SOLAR RETROFIT OPTION COMPLIANCE WITH YEAR 2000 AFEP GOALS	
Reduce Basewide Energy Consumption By 50%	49.2%
Reduce Basewide Fossil Fuel Consumption By 75%	61.3%

NOTE: The third AFEP Goal is to completely eliminate all consumption of natural gas by the year 2000. Since no natural gas is consumed at HWAAP, this goal is irrelevant to this study.

4.0 SHORT TERM ENERGY PLAN

The short term energy plan for the Hawthorne AAP consists of taking the necessary steps to initiate the projects within the Geothermal Conversion Option shown in Table 3.2.1. These steps are as follows.

- Begin implementation of the Increment F projects. This may require coordination through FE to incorporate minor repair type projects with regular maintenance work, or to coordinate multiple projects in one facility so as to reduce disturbance of occupants. This may also require funding requests through Facilities Engineering.
- Initiate steps to establish a geothermal production well and initiate the permitting procedure for the geothermal conversion project.
- Initiate steps to investigate the geothermal resource potential for application in the Ordnance Area.
- Implement the ECAM Project to Modernize Family Housing Building Envelopes. Investigate the possibility of coordinating this project with the geothermal building retrofit work to reduce disturbance of occupants.
- Implement the ECAM Project to Modernize Building Envelopes. In the Industrial Area, investigate the possibility of coordinating this project with the geothermal retrofit work.
- Based on the outcome of further geothermal reconnaissance in the Ordnance Area, implement the ECAM Project to Modernize Ordnance Area Steam and Condensate Systems.

BASEWIDE ENERGY SYSTEMS PLAN
HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

FINAL REPORT
EXECUTIVE APPENDIX

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BASEWIDE ENERGY SYSTEMS PLAN
HAWTHORNE ARMY AMMUNITION PLANT
HAWTHORNE, NEVADA

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APPENDIX A: GLOSSARY

APPENDIX A: GLOSSARY

1. A: Area (Ft^2)
2. AC: Air Changes - a method of expressing the amount of air leakage into/out of a building or room in terms of the number of building/room volumes exchanged; often expressed in terms of an hourly rate (i.e., AC/HR)
3. ACH: Annual Cooling Hours (Hr/Yr)
4. ADHW: Annual DHW Energy Use (Btu/Yr)
5. AHL_n : Annual Heat Loss (Btu/Yr) for a given building structure "n" (walls, roof, windows, etc.)
6. ALPHA: Refers to letters (as opposed to numerical referring to numbers)
7. AMBI: Ambient
8. ASHRAE: American Society of Heating, Refrigerating, and Air Conditioning Engineers
9. B_c : Total Building Steam Capacity (Btu/Hr)
10. BEAP: Building Energy Analysis computer Program
11. BF: Bypass Factor
12. BOILER HP: Boiler Horsepower - Equivalent to 3344 Btu/Hr or 34.5 Lbs of steam.
13. BTU: British Thermal Unit - Amount of heat energy required to raise the temperature of one pound of water one degree F.
14. CFM: Cubic Feet per Minute
15. CLF: Cooling Load Factor - Adjustment to instantaneous cooling load gains (Btu/Hr) to allow for the affect of time lag due to thermal storage.
16. CLTD: Cooling Load Temperature Difference - An equivalent temperature difference (allowing for the affect of solar radiation) used for calculating the instantaneous external cooling loads across opaque envelope structures ($\text{CLTD}^\circ\text{F} = q/\text{UA}$).
17. C.O.P.: Coefficient Of Performance - Ratio of the rate of heat removal to the rate of energy input, in consistent units, for a refrigerating plant, air conditioner, or heat pump under designated operating conditions.

$$\text{C.O.P.} = \frac{\text{Heat Removed (Btu/Hr)}}{\text{Work In (Btu/Hr)}}$$

GLOSSARY (Continued)

18. D-9: A designation given to structures or equipment so delapidated or obsolete that the only conscionable course of action is to remove the offending item to the nearest nuclear waste dump.
19. DEGREE DAY: A unit based on temperature difference and time, used in estimating fuel consumption and specifying nominal heating or cooling load of building. To determine Heating Degree Days (HDD) for any given day, when the mean temperature is less than 65°F, there are as many HDD's as degree fahrenheit difference in temperature between that day's mean temperature and 65°F.
20. DIESEL FUEL NO. 2: A distillate oil used for general purpose heating. Same as DF-2, Diesel Fuel, Fuel Oil No. 2.
21. DF-2: Diesel Fuel Oil No. 2
22. DHL_n : Design heat loss (Btuh/hr) for a given building structure "n" (i.e. walls, roof, windows, etc.)
23. DHW: Domestic Hot Water
24. DOE 2.1: Energy Analysis Computer Program
25. DUTY CYCLE: Hours of operation for a given structure or equipment.
26. E_n : Power rating of equipment "n" (kw).
27. ECAM: Energy Conservation And Management, same as ECIP but used for Contractor operated facilities.
28. ECIP: Energy Conservation Investment Program
29. ECM's: Energy Conservation Measures - steps or modifications applied building envelopes or mechanical system to rectify inefficient design and/or operational procedures.
30. ECONUS: An Economic Analysis Computer Program.
31. EEAP: Energy Engineering Analysis Program
32. E.E.R.: Energy Efficient Ratio - the ratio of net cooling capacity in Btuh/Hr to total rate of electrical energy input in watts under designated operating conditions. Similar to coefficient of performance (see C.O.R.).
33. E_{kwh} : Total annual equipment power usage (kWh/Yr).
34. EMCS: Energy Management Control Systems
35. ES: Energy Savings

GLOSSARY (Continued)

- 36. E.U.I.: Energy Utilized Index - a measure of the annual energy consumption in $\text{KBtu}/\text{Ft}^2\text{-Yr}$ of any structure, building component, equipment, etc.; and used to define the energy performance of these elements and changes in this due to any given modification.
- 37. °F: Degree Fahrenheit (also Degree F and DEG F)
- 38. °F Day: Degree Day
- 39. FC: Foot Candle - energy of light at a distance of one foot from a standard sperm oil candle.
- 40. FPM: Feet Per Minute
- 41. FPS: Feet Per Second
- 42. FT: Foot or Feet
- 43. Ft^2 : Square foot or feet (also Sq. Ft.)
- 44. FTHD: Feet of Hydraulic Column - a measure of the pressure termed in the height of a column of fluid, usually water which it would support.
- 45. FRACT: Fraction
- 46. FUEL OIL NO. 2: Diesel Fuel, Diesel Fuel No. 2, DF-2
- 47. FY: Fiscal Year
- 48. GAL: Gallon
- 49. GPD: Gallons Per Day (also Gal/Day)
- 50. GPH: Gallons Per Hour
- 51. GPM: Gallons Per Minute
- 52. GPY: Gallons Per Year (also Gal/Yr)
- 53. H_n : Annual hours of operation of a given piece of lighting equipment "n".
- 54. H/C: Heating/Cooling
- 55. HD: Head - a measure of pressure termed in the height of a column of fluid. (See FT. HD.)
- 56. HDD: Heating Degree Days

GLOSSARY (Continued)

- 57. HP: Horsepower - a unit of power equivalent to 550 Ft.-Lb./Sec. or 2543 Btu/Hr.
- 58. HR: Hour
- 59. HVAC: Heating, Ventilating, and Air Conditioning - usually refers to equipment or system type.
- 60. Hz: Hertz - one cycle per second.
- 61. I.D.: Inside Diameter
- 62. INFIL: Infiltration
- 63. IN H₂O: Inches of Water Column - A measure of pressure termed in the height of a column of fluid (see FT. HD.).
- 64. IN Hg: Inches of Mercury Column (see IN H₂O).
- 65. KBTU: One thousand (10^3) Btu
- 66. KV: Kilovolt or one thousand volts
- 67. KVA: Kilovolt Ampere
- 68. KW: Kilowatt or one thousand watts
- 69. KWH: Kilowatt Hour - Unit of energy equal to that expended by one kilowatt in one hour (equals 3413 Btu).
- 70. L_{kwh}: Total Annual Lighting Energy Use (kWh/Yr)
- 71. LB: Pound
- 72. LF: Linear Feet/Foot
- 73. MBTU: One million (10^6) Btu
- 74. MM: Mass Multiplier - thermal load modifier for building elements constructed of massive materials.
- 75. MWH: Megawatt * Hour - one million (10^6) watts per hour.
- 76. N: Number
- 77. NOAA: National Oceanic and Atmospheric Administration
- 78. O.D.: Outside Diameter
- 79. O.S.A.: Outside Air (also O.A.)

GLOSSARY (Continued)

- 80. P: Pressure
- 81. PSF: Pounds Per Square Foot
- 82. PSI: Pounds Per Square Inch
- 83. PSIA: PSI Absolute
- 84. PSIG: PSI Gauge
- 85. Q: Total heat or energy transfer.
- 86. R-H: Relative Humidity
- 87. RPM: Revolutions Per Minute
- 88. R-Value: The resistance to heat flow of a building element expressed in units of square feet * hour of temperature difference per Btu.
- 89. S: Second (also Sec.)
- 90. S_n : Annual hours of operation for a given piece of electrical equipment "n" other than lighting.
- 91. S.C.: Shading Coefficient - a multiplier relating the solar heat gain through a glazing system under a specific set of conditions to the solar heat gain through a reference glazing material under the same conditions (i.e. single pane double strength glass).
- 92. S.H.G.F.: Solar Heat Gain Factor - ASHRAE developed solar heat gain through fenestrations, calculated for daylight hours of the twenty-first day of each month for seventeen principal orientations.
- 93. SPPCo.: Sierra Pacific Power Company
- 94. T: Temperature Of (also Temp.)
- 95. T_n : Temperature of a given object or condition - "n".
- 96. T_{set} : Setpoint Temperature (also TS)
- 97. %T: Percent Total
- 98. Therm: A unit of energy equal to one hundred thousand (10^5) Btu.
- 99. TLF: Total Linear Feet
- 100. TON: One ton of refrigeration or cooling equal to 12000 Btu/Hr

GLOSSARY (Continued)

- 101. T-STAT: Thermostat
- 102. U-Value: A coefficient expressing the thermal transmittance of a building element expressed in Btu per square foot-hour-°F temperature difference. The reciprocal of R-Value.
- 103. U_n : U-Value for a given building component "n" (i.e. walls, windows, etc.).
- 104. VAV: Variable Air Volume HVAC System
- 105. Watt: A unit of energy equal to 3.413 Btu/Hr.
- 106. W_n : Total wattage of a given light type "n" (kWh).
- 107. WHR: Watt * Hour
- 108. YR: Year
- 109. c_p : Specific heat at constant pressure (Btu/Lb-°F)
- 110. db: Dry Bulb (also DB)
- 111. f_p : Friction Factor
- 112. g: Gravitational acceleration - constant equal to 32.17 Ft/Sec².
- 113. h: Enthalpy - total heat constant of a given mass of a substance (Btu/Lb-°F).
- 114. k: Thermal conductivity (Btu/Hr-Ft²-°F)
- 115. m: Mass Flow Rate
- 116. q: Time rate of heat flow (Btu/Hr)
- 117. s: Entropy - ratio of the heat added to a substance to the absolute temperature at which it was added.
- 118. wb: Wet Bulb (also WB)
- 119. α : (Alpha) coefficient of linear expansion (per °F) - also absorbtance (radiation).
- 120. β : (Beta) coefficient of volumetric expansion (per °F)
- 121. γ : (Gamma) ratio of specific heat
- 122. Δ : (Delta) difference between values
- 123. ϵ : (Epsilon) emissivity (radiation)

GLOSSARY (Continued)

- 124. η : (Eta) efficiency
- 125. λ : (lambda) wavelength
- 126. μ : (Mu) dynamic viscosity (Lb/Ft-Hr)
- 127. ν : (Nu) kinematic viscosity (Ft²/Hr)
- 128. ρ : (Rho) density (Lb/Ft³)
- 129. Σ : (Sigma) summation
- 130. σ : Stefan-Boltzman constant (0.173×10^{-8} Btu/Ft²-Hr-°R)
- 131. τ : (Tau) transmissivity (radiation)
- 132. ϕ : (Phi) diameter (also Phase)

APPENDIX B: REFERENCES

APPENDIX B: REFERENCES

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Appendix A: Detailed Scope of Work, Contract No. DACA05-81-C-0122, EEAP, Hawthorne AAP, 8 January 1982.

Supplemental Scope of Work, Contract No. DACA05-81-C-0122, EEAP, Hawthorne AAP, 21 January 1982.

Supplemental Scope of Work, Contract No. DACA05-81-C-0122, EEAP, Hawthorne AAP, 4 January 1983.

Supplemental Scope of Work, Contract No. DACA05-81-C-0122, EEAP, Hawthorne AAP, Increment F, 8 January 1982.

Supplemental Scope of Work, Contract No. DACA05-81-C-0122, EEAP, Hawthorne AAP, Increment C, revised 29 June 1982.

Supplemental Scope of Work, Contract No. DACA05-81-C-0122, EEAP, Hawthorne AAP, Increment E, 9 September 1982.

APPENDIX C: SCOPE OF WORK

SUPPLEMENTAL SCOPE OF WORK

CONTRACT NO. DACA05-81-C-0122

A-E: Chilton Engineering

1. Installation and Location: Hawthorne Army Ammunition Plant, Hawthorne, Nevada.
2. Subject: Energy Engineering Analysis Program, Hawthorne Army Ammunition Plant.
3. Authorization: HNDED Conference Minutes dated 15 July 1981, subject: Energy Engineering Analysis Program (EEAP).
4. Description of Work and Services Required:

a. Attached is the revised Scope of Work (SOW) for the subject project dated Rev 8 January 1982, which supercedes the 13 January 1981 Scope of Work. The revised Scope of Work incorporates all revisions mandated by the authorization listed above. There are numerous changes in the composition of the text that require no additional effort on the part of the A-E.

b. The paragraphs in the revised Scope of Work that will require additional effort by the A-E are marked with an "X".

5. Period of Service: See paragraph 5 on page 18 of the revised SOW. The period of service for the interim submittal has been changed from ninety (90) to one hundred and fifty (150) calendar days. All others remain unchanged.

6. Review and Correction: See paragraph 7.5 on page 14 of the revised SOW. Unchanged.

7. Submittals: See paragraph 4 on page 18 of the revised SOW. There is now a requirement for submittal of complete DD Forms 1391 and PDB-I for all readily justifiable energy conservation projects as early as possible in the interim (Phase II) stage of the study. Also, the number of copies of the final submittal has been reduced from twenty-five (25) to twenty (20) copies.

Randy Bedeen
RANDY BEDEEN
Project Manager

DISTRIBUTION:

A-E, Chilton Engineering
FE, Hawthorne Army Ammunition Plant - SARHW-FE
Mil Des Br, A-E Nego
Mil Des Br, Tech Rev
Mil Des Br, FESS (Redeen)(Orig)

SCOPE OF WORK

SUBJECT: Energy Engineering Analysis Program, Hawthorne Army Ammunition Plant, Hawthorne, Nevada

1. AUTHORIZATION: HNDED-PM letter dated 27 July 1981, Subject: FY82 Energy Engineering Analysis Program (EEAP).

2. DESCRIPTION OF WORK: The Architect-Engineer (A-E) shall:

2.1 Develop a systematic plan for the projects that will be developed to reduce energy consumption in compliance with the objectives set forth in the Army Facilities Energy Plan (AFEP).

2.2 Use and incorporate applicable data and results of related studies, past and current, as feasible.

2.3 Develop coordinated Basewide Energy Study.

2.4 Prepare Project Development Brochures (PDB's), Military Construction Project Data (DD Forms 1391) and supporting documentation for feasible energy conservation projects.

2.5 Include all methods of energy conservation which are practical (in so far as the state-of-the-art is reasonably firm) and determine the economic feasibility in accordance with guidance referenced herein.

2.6 List and prioritize all recommended energy conservation projects.

2.7 The long term objective is to implement a policy of becoming as energy self-sufficient as the state-of-the-art for energy conservation will allow within our resources and economic bounds set by the full implementation of our national energy policy as prescribed in the Army Facilities Energy Plan.

3. SCOPE OF WORK CONCEPT

3.1 The General Scope of Work is intended to apply to all military installations to be studied and to contain all general and common instructions and criteria. Detailed Scopes of Work for individual installations will be used to modify and amplify the General Scope of Work as required to make it applicable to the specific installation.

3.2 Since funding may be incremental, work to be performed is divided into seven increments. The seven increments are: Increment A - Energy conservation investigations for building and processes; Increment B - Energy Monitoring and Control Systems (EMCS) and local use of available waste fuels in existing energy plants; Increment C - Renewable energy projects, principally solar and biomass; Increment D - Cogeneration and solid waste plants, coal and POL storage and handling facilities, and waste fuel facilities; Increment E - Central boiler plant projects; Increment F -

Facilities Engineer conservation measures; and Increment G - Projects identified in Increments A and B that do not qualify under ECIP criteria.

3.3 The seven increments are divided into three phases:

3.3.1 Phase I - Data gathering and field trips.

3.3.2 Phase II - Analysis of data, identification of potential projects, feasibility and economic evaluation, and preparation of first pages of DD Forms 1391, including supporting data.

3.3.3 Phase III - Preparation of complete DD Forms 1391, Project Development Brochures (PDB's) and preparation of a report presenting the analysis, results, and recommendations of the study. DD Form 1391 and PDB are not required for Increments E and F.

3.3.4 There is a requirement for DD Form 1391 and PDB on all simple and readily justifiable energy conservation projects to be submitted in early as possible during Phase II.

3.3.5 It is anticipated that work in all three phases will be performed simultaneously after sufficient Phase I activity has occurred to allow Phase II and Phase III activities to begin.

4. GENERAL SCOPE OF WORK

4.1 General.

4.1.1 A coordinated Basewide Energy Study shall be developed. This study shall integrate the output of all energy conservation studies, projects or designs which have previously been done with the work done under this contract. It is not intended to prescribe the details in which the studies are to be conducted or limit the A-E in the exercise of his professional engineering experience, good judgment or investigative ingenuity. However, the information and analysis outlined herein are considered to be minimal essentials for adequate performance of the study. The A-E shall review the data contained in DOD Construction Criteria Manual 4270.1-M, the Master Planning Land Use Plan, and other data contained in Annexes to this Scope of Work. The A-E shall develop a comprehensive approach to energy usage in the most efficient and economical manner for the proposed construction projects. The study shall include a comprehensive installation energy report documenting study methods and results.

4.1.2 The A-E shall develop improvement projects that will reduce the energy consumption in compliance with the Army Facilities Energy Plan. All projects recommended will be ranked in order of highest energy-to-cost ratio. ECIP projects must amortize within and have a payback period of less than their economic life. Projects which will disrupt the occupancy of a facility shall be grouped together and performed at the same time, if practical.

X 4.1.3 All energy conservation measures which produce energy or dollar savings shall be documented in the report. Any energy conservation measures considered but eliminated shall be documented in the report with reasons for elimination. A checklist of energy conservation opportunities is included as

Appendix C to this scope. The items must be considered and the evaluation documented in the report. This list is not intended to limit or guide the A-E but only to assure that basic and generally repetitive opportunities are addressed in the report.

4.1.4 This study shall include all energy consuming buildings, facility processes, and facility support of production processes except those that use very little energy (i.e., storage areas) and those that are to be demolished. The work is reduced somewhat by building repetition, low energy use buildings and temporary buildings. The last, however, must be considered as having some extended use and will require coordination with demolition plans.

4.1.5 The A-E shall consider building upgrading, but only if this work is incidental to the energy savings improvement, i.e., a better finish insulated wall panel may be used in lieu of the more expensive wall modification necessary to install insulation. Projects must meet Energy Conservation Investment Program (ECIP) criteria; building upgrading solely for appearance or similar consideration is not acceptable. Changes that should be considered when designing new construction or modifying old construction to minimize operating and maintenance cost of mechanical systems and minimize energy demand over the life of the facility shall be proposed.

4.1.6 In the course of the field surveys, the A-E shall document and report instances of waste in use and operation of facilities relative to energy consumption and shall recommend methods of reduction or elimination of these wastes, such as "provide operable windows," "abandon temporary building," or "convert temporary building room office to storage," "reduce excessive exhausting of conditioned air," etc., where it is economically feasible and practical energy savings may be realized. The A-E should identify groups of buildings having centrally supplied heating and/or cooling in which energy consumption could be reduced by system or control revisions and make appropriate recommendations.

4.1.7 The "Energy Conservation Investment Program (ECIP) Guidance," dated 7 November 1977, and revised by message DAEN-MPO-U 2917700Z Dec 80, shall be used for performing the economic analyses, except for construction cost escalation. Construction cost escalation shall be calculated using Table 4 of AR 415-17. The technological updating factor which applies to energy conservation projects (category code 82500) has been increased to 1.10. Additional guidance is contained in EIRS Bulletin 81-01, 8 February 1981, Inclosure 1, and subsequent editions when revised. "Engineering Instructions for Preparation of Feasibility Studies for Total Energy, Selective Energy and Heat Pump Systems," dated 1 July 1977, and changes thereto, shall be used for performing life cycle cost studies. The first addresses projected dates at the end of the fiscal year (FY) in which the project was programmed and the end of the FY minus one, while the latter addresses dates of mid-point of construction, beneficial occupancy date (BOD), and BOD plus six months as times to which various cost figures are to be escalated. Therefore, assume all improvement projects will be awarded in FY-84 (mid-point of construction about mid-point of FY-87, BOD about end of FY-87). The construction cost of ECIP projects must be equal to or greater than \$100,000.

4.1.8 Data for major installations, subinstallations, satellites, and off post facilities shall be separately documented where applicable.

4.1.9 The study shall include distribution, and use of all energy sources. The energy sources include electricity, natural gas, liquified petroleum gas, bulk oil, other oil products, steam when procured, gasoline, coal, etc. Natural gas distribution systems capacity shall not be expanded without authority from the MACOM headquarters.

4.1.10 The storage and distribution of heating and cooling media such as steam, hot water, chilled water, etc., will be documented under heating as described in TB ENG 353. Provisions to increase storage capacity for peak cooling and heating periods will be a part of this study. The city planning technique described in the TB should be used where applicable.

4.1.11 The study will encompass the future population to be served. Military Aggregate Strengths published for use in master planning will be expanded by including all other personnel served, i.e., employees of all agencies on post, civilians, non-appropriated fund (NAF), all Contractor personnel employed on the post, etc., plus military dependents and transient quarters and guest facility occupants. Methodology used to compute the population over a 20 year period will be provided within the study.

X 4.1.12 Computer modeling shall be used to incorporate field survey data, weather data, occupancy schedules, building construction data, energy distribution systems, and equipment data into a model of the typical buildings and total base energy use. The computer shall be used to develop load profiles, calculate energy savings, and evaluate possible energy conservation measures such as shading, building mass, and solar. The computer model shall be capable of analyzing the energy requirements of buildings; performance of heating, cooling, and ventilating equipment; energy distribution systems; and energy conversion equipment. The computer model shall be verified against historical energy use or temporary metering installed by the A-E, and adjusted as required until reasonable agreement is obtained (typically within 10 percent). Computer or hand calculations methods may be used in combining the requirements of buildings groups, systems, and equipment efficiencies to obtain the basewide total energy use. Unless the BLAST (Building Loads Analysis and Systems Thermodynamic) program is used, the A-E shall submit a sample computer run example with an explanation of all input and output data and summary of program methodology and energy evaluation capabilities.

4.2 Increments of Work.

4.2.1 Increment A projects involve modifying, improving or retrofitting existing buildings (including family housing) to include architectural and structural features, HVAC systems, plumbing systems, interior or exterior building and parking facilities lighting. Projects shall be economically evaluated in accordance with provided ECIP criteria. Programming documents are required for those projects meeting ECIP criteria.

4.2.1.1. Each type of building or discrete part thereof shall be analyzed in terms of its energy consumption and load profile. List all buildings by type of function (barracks, warehouse, office, etc.) and identify specific characteristics affecting rate of energy consumption. Show

"U" value for each major building component, i.e., roof, ceiling, exterior walls, floor, windows, and doors. Show building heat gain, if air conditioned, and/or heat loss, if heated, in terms of BTUH at the design temperature differential. Each architectural and structural element, and each functional activity and process should be identified and its effect on the building energy consumption established. In order to accomplish this, population levels, functional activities and durations, historical and concurrent dry and wet bulb temperatures, etc., must be determined, and electrical demand and consumption shall be estimated and load curves developed.

4.2.1.2 Identify each energy source entering the building, estimate the BTU's of each energy source (in Mega BTU) consumed per year, the media and BTU's used for domestic water heating, the media and BTU's used for comfort heating, the media and BTU's used for comfort cooling. Electrical demand and consumption shall be estimated and load curves developed. In essence, an energy (or heat) balance shall be developed for each type of building at times of maximum usage or crucial functional activity. Identify building or equipment changes or modifications that would reduce energy demands in existing facilities for the life of the building not to exceed 25 years. Provide firm data to support recommendations.

4.2.1.3 The basic objectives of this part of the study are to collect and present in tabular and/or graphic form a complete energy consumption picture of the entire installation under designated operating procedures and conditions. Planned physical plant expansion with its associated population growth shall be included. The A-E shall analyze each element of an energy balance statement and make specific recommendations for improving performance. (Changes to relocate use remote sensors and thermostats in mechanical rooms or control of return air could prove fruitful). Proposals which would be technically and economically feasible but which would hinder or obstruct functional activities should be flagged for early resolution. Changes in system temperatures and flow rates shall be identified and evaluated. Heat pump systems shall be considered where there is a simultaneous requirement for both heating and cooling in a building or buildings in close proximity of one another. Present systems and procedures which are inefficient and energy intensive should be identified and recommendations made for correction.

4.2.1.4 As a portion of Increment A, the A-E shall evaluate facilities which are determined to have high energy consumption to analyze which buildings would benefit from the installation of appropriate types of meters. The resulting recommendation shall include location by building number, and sizes and types of meters to be installed. These facilities shall include, but not be limited to family housing, production, maintenance, storage and administration buildings.

4.2.1.5 If a promising application of solar energy is identified during Increment A, the A-E shall make a recommendation for a detailed analysis.

X 4.2.1.6 See Appendix E for reclassification of Increment G-only buildings as some will now require the detailed analysis described above.

4.2.2 Increment B projects involve utilities and energy distribution systems, EMCS for building and distribution systems, and existing energy plants. Projects shall be economically evaluated in accordance with ECIP criteria. Programming documents are required for those projects meeting ECIP criteria.

4.2.2.1 Systems to be studied shall include: electrical supply and distribution systems; steam, chilled water and hot water distribution systems including wells, pumps, storage and treatment facilities; and sewage collection and treatment facilities which are maintained and operated by the installation. Quantitative analyses of all energy distribution systems shall be made. Efficiency or coefficients of performance shall be determined for each type of system, i.e., the ratio of energy (or fuel) input to energy use or rejection. If possible, load profiles for each type of system shall be developed reflecting annual, monthly, weekly, daily and hourly consumption as appropriate. The information obtained from the survey of existing and proposed facilities shall be used to the fullest possible extent in developing the requirements for the EMCS if one is not presently in existence.

4.2.2.2 Develop a load profile by year for the past three years for each energy source procured (heating oil, natural gas, LPG, electricity). Identify the peak demand loads, essential loads, and unnecessary loads. The load profile charts with supporting data shall be submitted for review by the Government. The accuracy of these time related charts will influence the final recommendations made by the A-E.

4.2.2.3 Project energy costs three years from date of contract award and develop heating and cooling costs and lighting and other loads per square foot per year.

4.2.2.4 The A-E shall determine the feasibility of an EMCS for building electrical, mechanical and utility distribution systems. The intent of this study is to determine the basic conceptual architecture of the EMCS to the extent that primary economic calculations can be made to determine feasibility per ECIP criteria. The documentation shall be of sufficient accuracy to insure that future project design calculations that will be done after EEAP completion will not deviate more than 20 percent from the EEAP submittal.

4.2.2.4.1 The A-E shall survey all buildings and shall perform feasibility evaluations in accordance with guidance in HNDSP-80-013-ED-ME. The standard evaluation forms contained therein shall be a part of the submittal. EMCS analyses and evaluations shall be developed using TM 5-815-2. Any existing EMCS project or any currently under study shall be considered and evaluated for integration. EMCS evaluations shall consider but not be limited to the following features:

a. Start/Stop Programs.

- (1) Scheduling
- (2) Duty cycling
- (3) Load shedding for electrical demand limiting

- (4) Lighting control
- (5) Start/Stop Optimization
- b. Ventilation and Recirculation Program.
 - (1) Enthalpy economizer
 - (2) Dry bulb economizer
 - (3) Outside air reduction
- c. Temperature Reset Programs.
 - (1) Space temperature night setback
 - (2) Hot and cold deck
 - (3) Reheat coil
 - (4) Chilled water
 - (5) Chiller plant optimization
 - (6) Boiler plant optimization
- d. Labor Savings/Monitoring

X Example: Boiler plant monitoring (EMCS logging of points which at present are manually logged.)

4.2.2.4.2 The A-E's recommendations for an EMCS shall be in sufficient detail to define the system configuration, approximate quantity and types of control instruments and sensors, and data transmission system. The selection of points to be monitored and controlled shall be given priority based upon ECIP criteria. Development of data transmission system shall follow the procedures stated in ETL 1110-3-318. The control system functions, expected energy reduction, and monetary savings (including the manner in which these savings are to be achieved) shall be explained.

4.2.2.4.3 At those installations where certain buildings cannot be economically connected to an EMCS, an alternative means of control shall be evaluated. The use of FM radio control and current carrier control for military family housing is an example. The alternative control shall be interfaced to an existing or proposed EMCS.

4.2.2.4.4. The A-E shall prepare and provide recommendations in narrative form. Input/output (I/O) summary tables shall be prepared and provided for each system selected in accordance with HNDSP-80-013-ED-ME, cost estimates in accordance with HNDSP-80-013-EDME. Cost estimates shall be prepared and provided in accordance with HNDSP-80-013-EDME (Table II) for the mechanical and electrical modifications required to implement the EMCS.

X 4.2.2.4.5 Inoperative controls shall be noted with cost estimates to repair and replace as described in HNDSP 80-013-EDME.

X 4.2.2.4.6 Labor savings/monitoring shall be included, provided the E/C and benefit/cost (B/C) ratios are not affected to the extent of jeopardizing the ECIP requirements.

4.2.2.5 Existing energy plants shall be studied to determine the condition of existing equipment, efficiency of the plant equipment, operational procedures, adequacy of plant capacity, etc. Recommended modifications will be determined.

4.2.2.6 As a result of the data gathered and analyzed, the A-E shall develop graphic presentations, i.e., graphs, charts, etc., depicting the hourly kilowatt demand for peak load/demand days for each type of building with the exception of those which have little or no loads. This data shall be utilized to develop procedures to reduce the peak demand and accommodate load shedding.

4.2.2.7 If a promising application of solar energy is identified during Increment B, the A-E shall make a recommendation for detailed study.

4.2.2.8 See Appendix E for reclassification of Increment G-only buildings/utilities as some will now require the detailed analysis described above.

4.2.3 Increment C: Not authorized for award as yet.

4.2.4 Increment D: Not authorized for award as yet.

4.2.5 Increment E: Not authorized for award as yet.

4.2.6 Increment F: Not authorized for award as yet.

4.2.7 Increment G Projects: These feasible energy saving projects developed in increments A and B which do not qualify under ECIP criteria.

4.2.7.1 Identification of increment G projects for energy conservation will be accomplished during Phases I and II of Increments A and B. All projects including low cost items shall be documented based on energy savings, E/C ratio, B/C ratio, man-hours to accomplish the project and estimated cost. Projects will be listed in order of highest E/C ratio.

X 4.2.7.2 Economic analysis will be based on ECIP procedures. DD Forms 1391 and PDB's shall be prepared. A complete PDB is not required. Only the pertinent information required by the PDB format to define the work is necessary. The report shall contain all back-up data and shall present the information so as to permit the installation to easily update the economic evaluations. The requirements of AR 415-15 and AR 415-35 shall be followed for major and minor construction projects respectively. For maintenance and repair projects, the requirements of DA Pamphlet 420-6 and AR 420-10 shall be followed. Prior to preparing programming documents A-E shall review all proposed projects with the Facilities Engineer. In lieu of DD Forms 1391 and PDBs, work orders or local projects may be prepared if so desired by the Facilities Engineer.

X 4.2.7.3 See Appendix E for reclassification of Increment G-only buildings.

4.3 Phases of Work.

4.3.1 Phase I shall consist of gathering data and inspection of facilities in the field. These activities must be closely coordinated with the Contracting Officer and the Facilities Engineer representatives. In addition to examination of physical facilities, plans, records and prior studies, the A-E shall observe operating procedures and methods. Data sources should be identified and assumptions clearly stated and, if necessary, adequately justified.

4.3.1.1 The A-E shall compile quantitative lists of all raw energy consumed annually, by population and facilities served, as related to and required for energy analysis, to include:

- a. Production cycles.
- b. KW hours of electricity and peak demands.
- c. Therms of gas by type (NG, LPG, Propane, etc.).
- d. Gallons of oil by grade.
- e. Other, if any (such as purchased steam, chilled water, coal, refuse derived and waste oil fuel, etc.).
- f. Personnel and building occupancies.
- g. Weather data.
- h. Total energy usage for fiscal year 1975 shall be collected or estimated by calculations to provide reference base for use by the facility.

4.3.1.2 The A-E shall become thoroughly familiar with each installation and undertake all necessary field trips to obtain required data. Where there are a number of similarly constructed buildings performing the same function, a representative sample may be surveyed and analyzed. Proposed future construction shall be considered. Buildings shall be listed and identified by the installations's numbering system and also by function and title. The building list shall contain items relating to and required for energy analysis and shall include, but not be limited to:

- a. Square footage of floor area of heated and/or air conditioned spaces.
- b. Type of construction and "U" values.
- c. Window area and door openings (include dock doors).
- d. Type and capacity of HVAC systems.
- e. Type and capacity of domestic water and process water heating systems.
- f. Building heat gain and heat loss.

g. Types of energy entering the buildings with estimated or metered consumption expressed in BTU for development of load profiles.

h. Estimated or documented electrical demand (KW) and electrical energy consumption (KWH/yr.).

i. Process energy systems.

4.3.2 Phase II shall consist of analysis of data, performance of feasibility and economic studies, the identification of proposed projects and preparation of the first pages of the DD Forms 1391. During this phase, all potential energy conservation measures which produce energy and/or dollar savings shall be identified and evaluated as to technical and economic feasibility. Energy conservation measures determined to be technically and economically feasible shall be combined into projects and ranked according to highest E/C ratio. All simple and readily justifiable energy conservation projects shall be submitted as early as possible, with programming documents (DD Forms 1391 and PDBs).

4.3.2.1 Military Construction Project Data (DD Form 1391): These
X documents shall be prepared in accordance with AR 415-15, Chapter 7 and the supplemental requirements stated below. Early identification of feasible projects and development of the corresponding DD Forms 1391 are essential and shall be accomplished as required by this Scope of Work. These forms shall be separate from the report. They shall be bound similarly to the report in a manner which will facilitate repeated disassembly and reassembly. Preparation of DD Form 1391 requires completion of a concise summary form outlining the project description, project cost estimate and the basis for implementation of the project. This summary form also requires information specifying the agency in charge of the project, the location of the project, assignment of a project number and the fiscal year for implementing the project. The form shall include a statement that the project results from the EEAP study. Projects which will disrupt the occupancy of a facility shall be grouped together and performed at the same time, if economically feasible and practical. Documents shall be complete as per requirements of submission to higher DA headquarters. These programming documents will require signatures by the proper installation officials prior to summittal of required quantities. To facilitate ECIP project approval, the following supplemental requirements shall be provided:

a. In title block clearly identify projects as "ECIP."

b. Include complete description of each item of work to be accomplished including quantity, square footage, etc..

c. Provide a comprehensive list of buildings involved include building numbers, square foot floor area, designated temporary or permanent, and usage (baracks, admin, etc.). For temporary buildings indicate final year of scheduled use.

d. List references, assumptions, and provide calculations to support dollar energy savings, and indicate any added costs.

(1) If a specific building is used for sample calculations; identify building number, category, orientation, square footage floor area, window and wall area for each exposure.

(2) Identify weather data source.

(3) Identify infiltration assumptions before and after improvements.

(4) Provide and justify inside temperature profiles before and after retrofit. Include source of expertise and demonstrate savings claimed by work sample techniques.

e. Claims for boiler efficiency improvements must identify data to support present properly adjusted boiler operation and future expected efficiency. If full replacement of boilers is indicated, explain rejection of alternatives such as replace burners, nonfunctioning controls, etc. Assessment of complete existing installation is required to make accurate determination of required retrofit actions.

f. Lighting retrofit projects must identify number and type of fixtures, and wattage of each fixture being deleted and installed. New lighting should be only of the level to meet the DOD 4270.1 Criteria. Lamp changes in existing fixtures is not considered an ECIP type project.

g. An ECIP Economic Analysis Summary as shown in the ECIP Guidance is to be provided for the complete project and for each type of retrofit action included in the project. Acceptable minimum B/C and E/C ratios given in the guidance are applicable to all segments of the project.

h. The DD Form 1391 face sheet should include, for the complete project, the annual dollar and MBTU savings, B/C ratio, E/C ratio, simple amortization period in years, and a statement attesting that all buildings and retrofit actions will be active use throughout the amortization period.

X 4.3.2.2 Project Development Brochures: Preparation of PDBs requires the A-E to delineate the functional requirements of the project as related to the specific site. The A-E shall prepare PDBs in accordance with AR 415-20 and TM 5-800-3. Some projects may not require all the forms and checklists included in TM. Only that information needed for the project shall be included. The FDB-I format described in the TM shall be used for whatever information is needed. The PDB-II may be deleted if so directed by the Contracting Officer.

4.3.3 Phase III shall consist of the preparation of the programming documents (complete DD Forms 1391 with Detailed Justifications and PDB's) and a report presenting the results and recommendations of the study for each installation.

4.3.3.1 Programming Documents: Complete Military Construction Project Data (DD Form 1391 with Detailed Justifications) and Project Development Brochures (PDB's) shall be prepared for the top ten (10) prioritized projects as determined in Phase II unless directed otherwise.

4.3.3.1.1 Military Construction Project Data (DD Forms 1391 and 1391c): The Detailed Justifications shall be prepared as required for each selected project in accordance with AR 415-15, Chapter 8, excluding paragraph 14. (The PDB is to be prepared as an integral part of Phase III.) These forms shall be incorporated with the applicable first pages of the DD Forms 1391

prepared in Phase II and bound in a similar fashion. The documents shall be completed in sufficient detail with proper signatures to effect a submittal to higher DA headquarters.

4.3.3.1.2 Project Development Brochures, Part I: The A-E shall complete all data as required for each final PDB in accordance with AR 415-20 and TM 5-800-3, Project Development Brochure. Preparation of the PDB's requires the A-E to delineate the functional requirements of the project as related to the specific site. The brochure is required in support of DD Forms 1391. Some projects may not require all the forms and checklists included in the TM. Only that information needed for the project shall be included. The PDB-I format described in the TM shall be used for whatever information is needed. The PDB-II may be deleted if so directed by the Contracting Officer.

5. DETAILED SCOPE OF WORK:

See Appendix A.

6. REFERENCE DOCUMENTS:

See Appendix B.

7. SUBMITTALS:

7.1 Format: Formal narrative and tabular data shall be typed and printed on 8-1/2" x 11" sheets with fold-outs for maps, sketches, schematics, charts, graphs and other illustrative material, as necessary. Generally, all formal narrative text shall be typed in lines perpendicular to the longest axis of the sheet. Data which cannot be clearly described in narrative form shall be graphically shown. Formal documents shall be securely bound with hard paper or a flexible material in a durable and attractive manner. The title of the documents shall appear on the cover of all submittal documents. All final documents shall be bound in a manner which will facilitate repeated disassembly and reassembly, and the title shall appear on the bound edge, in a secure manner, as well as the cover. Narrative contents of the document(s) shall be arranged in a logical sequence and organized by sections, unless otherwise specified. A decimal system, similar to the Dewey Decimal System, should be used to organize and label section topics and subtopics. Pages, paragraphs, charts and graphs will be numbered. References to information contained elsewhere within the contents of the document(s) shall be properly noted. All data sources used in preparing the information presented in the document(s) shall be appropriately referenced.

7.2 Report Submittals: A preliminary, interim, pre-final submittal and final report shall be required for each installation. The purpose of the preliminary submittal is to insure that the work is being performed on schedule within the guidelines established herein. The interim submittal shall provide each installation with pertinent data concerning energy usage and feasible energy conservation measures. The final report shall present the coordinated Basewide Energy Study which integrates all aspects of the scope of work.

7.2.1 Preliminary Report: The Preliminary Report shall be submitted at the completion of Phase I. The A-E shall submit the scope of work for the installation studied, and the minutes of the Scope Clarification Conference,

as an appendix to the submittal. The A-E shall indicate which studies have been accomplished to date, the methods of approach utilized, progress to date, and justifications for the studies and approaches; reveal problems encountered or resulting from the study, present information the A-E considers pertinent and propose an outline of how the A-E plans on addressing Phase II of the Study. A review of the Preliminary Report shall insure that the work is being performed on schedule. Upon completion of the review the A-E shall be granted authorization to proceed or redirection for the study as required.

7.2.2 Interim Report: The interim report shall be prepared as formal documents and submitted at the completion of work on Phase II. The A-E shall submit the scope of work for the installation studied, and the minutes of the Scope Clarification Conference, as an appendix to the submittal. This report shall contain a narrative summary of the conclusions and recommendations together with all raw and supporting data, methods used and sources of information. Copies of the first pages of DD Forms 1391 with supporting data will be submitted with the report as specified herein. The summary shall include the order of priority in which the recommended tasks should be accomplished. The A-E shall separately identify feasible projects that meet ECIP criteria and shall submit preliminary first page of DD Forms 1391, including supporting data. During the review period, the Contracting Officer will coordinate with Installation and MACOM representatives and provide the A-E with direction for packaging projects for programming purposes.

7.2.3 Draft Final Report: The report shall be a Basewide Energy Study submittal all of the work under this contract is complete. The A-E shall submit the scope of work for the installation studied, and the minutes of the Scope Clarification Conference, as an appendix to the submittal. Each submittal shall contain a narrative summary of conclusions and of recommendations together with all raw and supporting data, methods used and sources of information. DD Forms 1391 and PDB's shall be submitted as part of the report in accordance with guidance specified herein. The report shall cover the entire scope of the study and shall include the order of priority in which the recommended tasks should be accomplished. The program documents shall be complete and ready for signature by the installation commander.

7.2.4 Final Report: The final formal documents shall be 100% complete incorporating all changes resulting from the previous submittals and associated reviews. The A-E shall submit the scope of work for the installation studied, and the minutes of the Scope Clarification Conference, as an appendix to the submittal. The report shall cover the entire scope of the study and shall include the order of priority in which the recommended tasks should be accomplished. Due to the volume of data involved, separately bound volumes should be prepared for the following items.

7.2.4.1 Executive Summary: An Executive Summary shall be prepared for each final submittal. See Appendix D for minimum requirements for the executive summary.

7.2.4.2 Main Report: The main report shall be a narrative report constituting the Basewide Energy Study for each installation. It shall contain a summary and data for all increments studied. May be more than one volume. Increment "F" shall be included in narrative report and also bound separately.

7.2.4.3 Appendices: The appendices shall contain detailed calculations and reference material in support of the study.

7.2.4.4 Programming Documents: The programming documents shall include the separately bound DD Forms 1391 with justifications and the Project Development Brochures for the required number of projects. The documents shall be complete as per requirements for submission to higher DA Headquarters and ready for signature by the Installation Commander. The originals shall be submitted to the Contracting Officer's representative for further distribution and action. Joint-funded projects require multiple programming documents.

7.2.4.5 Additional items to be bound separately: Sample computer outputs, completed survey forms, etc.

7.3 Presentations: The A-E may be required to give a brief presentation of each submittal before an assembly of installation, command and other government personnel. A comprehensive review of the report will be conducted immediately following the presentation. During the presentation, the personnel in attendance shall be given ample opportunity to ask questions and discuss any changes deemed necessary to the study. The presentation will be at the installation on date(s) agreeable to the A-E and the Contracting Officer. It is anticipated that each presentation and review conference will require approximately one working day.

7.4 Conferences: Periodic meetings may be scheduled whenever requested by the A-E or Contracting Officer for the resolution of questions or problems encountered in the performance of the work. The A-E and/or the appropriate representative(s) shall be required to attend and participate in all conferences pertinent to the work required under this contract as directed by the Contracting Officer.

7.5 Review Comments: Comments resulting from the review procedures will be forwarded by the Contracting Officer to the A-E for incorporation into subsequent submittals. The A-E shall furnish written notification of intended action on each comment to the Project Manager within three weeks after the review meeting. Intentions of noncompliance with any comment should be substantiated in detail. Authorization to proceed to the next revised submittal will be granted in writing with or after the Contracting Officer's approval of the A-E's intended actions on the review comments. The final submittal will be 100% complete in compliance with all review comments or written rebuttals for noncompliance.

7.6 Resubmittal of Inadequate Documents: The Contracting Officer may require a resubmittal of any document(s) if such document(s) are not approved because they are determined by the Contracting Officer to be inadequate for the intended submittal purpose.

7.7 Scheduling and Reporting Progress: The A-E shall prepare and submit an activity diagram or schedule with the first monthly report which will indicate individual activities, significant events and milestones along with schedule dates for each. The schedule shall cover the entire scope and work period of the contract. In addition, the A-E shall submit monthly reports of progress. These reports may be in letter or chart form and should be worded or keyed to indicate progress on the activity diagram. A copy of the monthly report and schedule shall be furnished to the installations representative.

8. PERIODS OF SERVICE

8.1 Milestone Dates: Expeditious completion of each phase and increment of this contract is essential to the accomplishment of the energy conservation goals. Milestone dates, or time allowed for each submittal based on a given number of calendar days, are included in the Detailed Scopes of Work for each installation.

8.2 Review Time: Time allowed for preparation and submission of the information and/or documents required by this contract are exclusive of documented Government review time. Government review time for a submittal is the period of time from the documented date of receipt of the submittal by the Government until the documented date of receipt by the A-E of the Contracting Officer's authorization to proceed with the work for the next submittal.

9. MISCELLANEOUS INSTRUCTIONS

9.1 Project Manager. The A-E and the Contracting Officer shall designate a project manager to serve as a single point of contact and liaison for all work required under the contract. Upon the award of the contract, these individuals shall be immediately designated in writing. The A-E's designated project manager for the contract must be approved by the Contracting Officer prior to commencement of work. This designated individual shall be responsible for complete coordination or work required under this contract.

9.2. Installation Assistance. A project engineer designated by the Commanding Officer at each installation will serve as the point of contact for obtaining available information and assisting in establishing contacts with the proper individuals and organizations as necessary in the accomplishments of the work required under this contract.

9.3 Records: The A-E shall be required to maintain and provide upon request a record of all communications with Government representatives relative to this contract in which the A-E and/or the designated representative(s) participated.

9.3.1 The A-E shall be required to provide a record of all significant conferences, meetings, discussions, verbal directions, telephone conversations, etc., with Government representative(s) relative to this contract in which the A-E and/or designated representatives thereof participated. These records shall be dated and shall identify the contract number, and modification number if applicable, participating personnel, subject discussed and conclusions reached. The A-E shall forward to the Contracting Office, as soon as possible (not to exceed ten (10) calendar days) a reproducible copy of the records when requested.

9.3.2 The A-E shall be required to provide a record of requests for and/or receipt of Government-furnished material, supplies, data, documents information, etc., which if not furnished in a timely manner, would significantly impair the normal progression of work under this contract. The records shall be dated and shall identify the contract number and modification number, if applicable. The A-E shall forward to the Contracting

Officer, as soon as possible (not to exceed ten (10) calendar days), a reproducible copy of the record of receipt when requested.

9.4 Public Disclosures: The A-E shall make no public announcements or disclosures relative to information contained or developed in this contract, except as authorized by the Contracting Officer.

9.5 Although it will be necessary to coordinate data gathering field activities with the installations, the A-E is reminded that his contract is with the Sacramento District, and therefore, any guidance or instructions relative to the Scope of Work must be initiated by the Project Manager.

9.6 The A-E is to provide points of contact, by name and office, of personnel who assist in providing or developing the data contained in the Study.


RANDY REDEEN
Project Manager

DISTRIBUTION:

A-E, Chilton Engineering
FE, Hawthorne Army Ammunition Plant, SARHW-FE
Mil Des Br, A-E Nego
Mil Des Br, Tech Rev
Mil Des Br, FESS (Redeen) (orig)

APPENDIX A

DETAILED SCOPE OF WORK

Hawthorne Army Ammunition Plant, Hawthorne, NV

1. PROJECT DATA:

- 1.1 Subject: Energy Engineering Analysis Program.
- 1.2 Installation & Location: Hawthorne Army Ammunition Plant, Hawthorne, NV
- 1.3 Study Title: Basewide Energy Study, Hawthorne Army Ammunition Plant, Hawthorne, NV

2. GENERAL:

2.1 This Detailed Scope of Work applies specifically to the Basewide Energy Study for Hawthorne Army Ammunition Plant (HWAAP).. It is intended to supplement the General Scope of Work which was prepared for all military installations. Should conflicts occur between the General Scope of Work and the Detailed Scope of Work, the Detailed Scope of Work shall govern.

2.2 Site Visits, Inspections, and Investigation: The A-E, his consultants, if applicable, and/or designed representative(s) thereof shall visit and inspect/investigate the site of the project as necessary and required during the preparation and accomplishment of the work. All resulting travel costs and expenses incurred are included in the lump sum price of the contract.

2.3 Services and Materials: All services, supplies, materials (except those specifically enumerated to be furnished by the Government), plant, labor, superintendence and travel necessary to perform the work and render the data required under this contract are included in the lump sum price of the contract.

3. RELATED PROJECTS AND/OR STUDIES:

3.1 The following is a tabulation of existing energy and related studies and projects at HWAAP. The current status of each project is indicated. As stated in the General Scope of Work the A-E is to give proper consideration to all previous studies and projects and incorporate them into the analysis.

<u>Project</u>	<u>Status</u>
a. ECIP Improvements- Family Housing.	Under Construction.
b. FESA Feasibility Study of Supplementing the Heating of HWAAP Indoor Swimming Pool, 8 July 1980.	Study Complete.
c. FESA Energy Conservation Survey of Selected Buildings, HWAPP, March 1980.	Study Complete

3.2 Documents relating to all of the above projects are available either through the Project Manager or the Installation Facilities Engineer.

4. SUBMITTALS:

4.1 All submittals will be made in accordance with the criteria outlined in paragraph 7 of the General Scope of Work. Each submittal may include an oral presentation at the Installation upon completion of the review. The submittals will include the following:

4.1.1 Preliminary: Due upon completion of Phase I for increments negotiated under the basic contract. Also include a narrative discussion of the methodology proposed for Phase II and an outline of the final report for approval by the Contracting Officer. Provide fifteen (15) copies for review.

4.1.2 Interim: Due upon completion of Phase II for above negotiated increments. Include first pages of DD Forms 1391 for all viable energy conservation project. This submittal will also include a prioritized listing of all recommended energy conservation projects. Provide twenty (20) copies.

4.1.3 Pre Final Report: Due upon completion of Phase III for above negotiated increments. This submittal shall include all material developed in accordance with the General Scope of Work. Provide twenty (20) copies.

4.1.4 Final Report: Provide all data developed throughout the study including the following items:

4.1.4.1 Executive Summary.

4.1.4.2 Main Report.

4.1.4.3 Appendices.

4.1.4.4 Programming Documents (DD Forms 1391 with Detailed Justifications and PDB's).

4.1.4.5 Supplemental Supporting Data.

4.1.4.6 All documents will be prepared as specified by the General Scope of Work. Provide originals plus twenty (20) copies.

5. PERIOD OF SERVICE:

5.1 The periods of service will not include any Government review time. Transmittal time for the A-E to the Government also will not be included. The periods of service will be as follows:

5.1.1 Preliminary: Due one hundred and fifty (150) calendar days from the date of Notice to Proceed.

5.1.2 Interim: Due one hundred and fifty (150) calendar days from the receipt of authorization to proceed into Phase II.

5.1.3 Prefinal: Due forty-five (45) calendar days from receipt of authorization to proceed into Phase III.

5.1.4 Final Report: Due twenty-one (21) calendar days from receipt of authorization to proceed with work on the Final Report.

For the purpose of negotiating the contract the basic work item is Phases I, II & III of Increments A, B & G as defined by the General Scope of Work. The balance of the work will be negotiated through supplemental work requests.

7. POINTS OF CONTACT:

7.1 Sacramento District: Randy Redeen, Project Manager, Facilities Engineering Support Section, (916) 440-2874.

7.2 Hawthorne Army Ammunition Plant: Floyd L. Justus, Chief Engineer, (707) 945-7020.

APPENDIX B

REFERENCE DOCUMENTS
(Government Furnished)

1. Army Facilities Energy Plan dated 1 October 1978.
2. Department of Defense Construction Criteria Manual, DOD 4270.1M, dated 1 October 1972.
3. "Energy Conservation Investment Program (ECIP) Guidance," dated 7 November 1977, revised by DAEN-MPO-U message, DTG 291700Z Dec 80.
4. DAEN-MCE-U "Engineering Instructions for Preparation of Feasibility Studies for Total Energy, Selective Energy, and Heat Pump Systems" dated 1 July 1977.
5. TB ENG 353, "The Overlay-Composite Method of Master-Plan Preparation" dated December 1966 (with sample brochure).
6. AR 11-27, "Army Energy Program," dated 20 July 1976.
7. AR 415-15, "Military Construction, Army (MCA) Program Development," draft dated 17 December 1979.
8. AR 417-17, "Cost Estimating for Military Programing" dated 15 February 1980 and the current extract from the Engineering Improvement Recommendation System (EIRS) Bulletin.
9. AR 415-20, "Project Development and Design Approval," dated 28 March 1974.
10. AR 415-35, "Minor Construction," dated 1 February 1979.
11. AR 420-10, "General Provisions, Organization, Functions, and Personnel," dated 20 December 1977.
12. DA Pam 420-6, "Resources Management System," dated 15 May 1978.
13. TM 5-800-3, "Project Development Brochure," draft dated 1980.
14. TM 5-810-1, "Heating, Ventilating & Air Conditioning," dated July 1965.
15. TM 5-815-2, "Energy Monitoring & Control Systems," dated 1 August 1980.
16. ETL 1110-3-243, "Unitary Heat Pumps," dated 30 October 1975.
17. ETL 1110-3-246, "Total Energy Systems," dated 21 November 1975.
18. ETL 1110-3-256, "Mechanical Design Guidance," dated 28 September 1976.
19. ETL 1110-3-266, "Domestic Hot Water Temperatures," dated 20 April 1977.
20. ETL 1110-3-271, "Interior Mechanical Design for Army Medical Facilities," dated 29 July 1977.

21. ETL 1110-3-282, "Energy Conservation," dated 10 February 1978.
22. ETL 1110-3-294, "Interior Design Temperatures," dated 15 September 1978.
23. ETL 1110-3-295, "Energy Budgets," dated 10 October 1978.
24. ETL 1110-3-296, "Economic Studies," dated 11 October 1978.
25. ETL 1110-3-302, "Evaluation of Solar Energy," dated 14 March 1979.
26. ETL 1110-3-318, "Procedures for Programing Energy Monitoring and Control Systems (EMCS) Funded Through the MCA Program," dated 8 February 1980.
27. HNDSP-80-013-ED-ME, "Preliminary Survey & Feasibility Study for Energy Monitoring & Control Systems," undated.
28. Executive Order 12003, "Energy Policy and Conservation," dated 20 July 1977.
29. Executive Order 11593, "Protection and Enhancement of the Cultural Environment," dated 13 May 1971.
30. Public Law 89-665, "Historic Properties - Preservation," approved 15 October 1966.
31. Public Law 90-480, "Public Buildings - Handicapped Persons," approved 12 August 1968.
32. DAEN-MPE-E letter dated 27 April 1979, subject: Energy Engineering Analyses (EEA) Program (Basewide Energy Studies) - Feasibility of Projects Studied.
33. DAEN-MPE-E letter dated 12 July 1979, subject: Progress Chart, Field Data Forms, and Report Format for Engineering Energy Analysis Projects (Basewide Energy Studies).
34. DAEN-MPE-E letter dated 13 July 1979, subject: Existing Time Clocks vs. ECIP/EMCS Projects.
35. * Building Information Schedule.
36. * Basic Information Maps and Plans.
37. * Land Use Plan.
38. * Utility Procurement Records.
39. * Military Aggregate Strengths.

* To be obtained from Installation FE if available.

APPENDIX C

ENERGY CONSERVATION OPPORTUNITIES

- o Insulation
- o Storm windows or double glazing
- o Weather stripping and caulking
- o Insulated panels
- o Solar films
- o Vestibules
- o Load dock seals
- o Reduction of glass area
- o Replace kitchen light fixtures
- o Shutdown energy to hot water heaters or modify controls
- o Energy conserving flourescent lamps
- o Reduce lighting levels
- o Replace incandescent lighting
- o Use more efficient lighting source
- o Improve power factor
- o High efficiency motor replacement
- o Night setback/setup
- o Infrared heaters
- o Enconomizer cycles
- o Control hot water circulation pump
- o FM radio controls
- o Radiator controls
- o Decentralize domestic hot water heaters
- o Install shower flow restrictors
- o Heat reclaim from hot refrigerant gas
- o Reduce air flow

- o Prevent air stratification
- o Install time clocks
- o Boiler oxygen trim control
- o Blowdown heat recovery
- o Revise boiler controls
- o Chiller controls
- o Chiller replacement
- o Replace absorption chiller
- o Reduce street lights
- o Insulate steam lines
- o Return condensate

APPENDIX D

EXECUTIVE SUMMARY

1. Introduction
2. Existing energy consumption
 - o Basewide consumption FY 1975
 - o Source energy consumption

Electricity	- KWH	Dollars	BTU
Fuel Oil	- Gals.	Dollars	BTU
Natural Gas	- Therms.	Dollars	BTU
Propane Gas	- Gals.	Dollars	BTU
Other	- Gals.	Dollars	BTU
 - o Total annual energy used
 - o Building group source energy consumption
 - o Typical building energy consumption
3. Energy conservation measures developed
 - o ECMs investigated
 - o ECIP projects developed (provide list)
 - o Other energy conservation projects
 - o Policy changes/recommendations
4. Energy and cost savings
 - o Base-wide consumption after energy conservation projects
 - o Allocation of energy conservation project savings
 - o Projected energy consumption
 - o Project energy costs
5. Increment "C" - Renewable Energy, Principally Solar and Biomass
 - o Scope
 - o Results and recommendations
6. Increment "D" - Cogeneration and Solid Waste
 - o Scope
 - o Results and recommendations

7. Increment "E" - Central Boiler Plants
 - o Scope
 - o Results and recommendations
8. Increment "F" - Facility Engineer Conservation Measures
 - o Info from paragraphs 4.2.6.9, 4.2.6.10, and 4.2.6.11
9. Energy Plan
 - o Matrix of actions and savings
 - o Percent reductions by 1985
 - o Energy usage per ft.² by 1985
 - o Project breakouts with total costs and ECIP ratio
 - o Schedule of energy conservation projects

APPENDIX E

Reclassification of Increment G Only Buildings

<u>Bldg No.</u>	<u>Building Description</u>	<u>Remarks</u>
101-2	Box Opening Plant #1	Duplicated of Bldg 101-12 already included in Increment A. Add these into Increment A, however, only do a quick walk-through to identify any major differences from Bldg. 101-12
101-19	Bult TNT Storage & Box	
101-10	Box Opening Plant	
101-20	" " "	
101-13	" " "	
101-3	" " "	
101-27	Paint Locker	
101-28	" "	
101-29	" "	
103-14	" "	
103-22	" "	
103-23	" "	
103-24	" "	
103-25	" "	Delete from further study
103-33	" "	
104-10	" "	
104-11	" "	
104-12	" "	
104-13	" "	
108-8	" "	
108-26	" "	
110-99	" "	
15-100	" "	
101-5	Filling Plant #1	Add into Inc. A. A detailed analysis is underway for Plant #3, therefore only a quick walk-through will be req'd for these plants.
101-7	" " #2	
101-17	" " #4	
C-66	Golf Course Lockers	Add to Incr A - Detailed Analysis
375	Sentry Station	" " " " " "
C-194	Admin General Purposes	Add to Incr A - Detailed Analysis (Inactive Bldg.)
101-22	Case Prep Plants #3 & #4	Duplicate of 101-21 already in Increment A. Add into Incr A, however only quick walk-through req'd.
103-17	Fuse Overhaul	Add into Incr A - Detailed Analysis.
71	Pump House - Well #1	Add into Incr B - Detailed Analysis #2 thru #8 should be identical to pump house well #1, therefore only a quick walk-through of these is required.
72	" " " #2	
73	" " " #3	
74	" " " #4	
C661	" " " #6	
168	" " " #7	
170	" " " #8	

APPENDIX E (Cont'd)

<u>Bldg No.</u>	<u>Building Description</u>	<u>Remarks</u>
EPWR	Electric Power Plant	This is Bldg 70 which is already covered by Increment B.
STRLT	Ext. Lighting	Add Into Incr B
2 ExLt	" "	" " " "
3 ExLt	" "	" " " "
1 ExLt	" "	" " " "
1 Tran	Substation	Add Into Incr B
2 Trans	"	" " " "
1 Conl	Steam Condensate Lines	Add Into Incr B
2 Conl	" " "	" " " "
1 Stml	" " "	" " " "
2 Stml	" " "	" " " "
AIRDS	Compressed Air Line	Add Into Incr B
A15	Security Office	Defer to Increment F
C 428	Interior Workshop	" " " "
C 665	Chlorinator Building	" " " "
40	" House	" " " "
334	" Building	" " " "
357	" "	" " " "
101-70	At Black Beauty Reservoir Air Compressor Building	" " " "
A17	Security Office	Delete from further study
302	Carpenter Shop	" " " "
488	Pump Station	" " " "
171	Pump Station	" " " "
75	Pump House-Well #5	" " " "
391	Sewage Pump Building	" " " "
A20	Interior Workshop	" " " "
A358	Patio-Swimming Pool	" " " "
B-111	Barracks	" " " "
60	Cabin	" " " "
Clarification of Specific Increment A, B & G Buildings		
102-31	Ammunition Renovation	This Bldg was identified originally as a duplicate to Bldg 103-7. It is not; therefore, a detailed analysis is required.
103-16	Projectile Overhaul	Originally identified as a duplicate of 103-8. It is not; therefore, a detailed analysis is required.
A10	Machine Shop	Originally identified as a duplicate of Bldg A8. It is not; therefore a detailed analysis is required.

CONFERENCE MINUTES

SUBJECT: Basewide Energy Systems Plan, Hawthorne Army Ammunition Plant,
Hawthorne, NV

1. On 13 January 1981 a Scope Clarification Conference for the subject energy study was held at Hawthorne Army Ammunition Plant (HWAAP), Hawthorne, NV. The following persons were in attendance:

<u>NAME</u>	<u>REPRESENTING</u>
Floyd L. Justus	HWAAP, Chief Engineer
Cliff Cichowlaz	DZB, Fac Engr Div
Ralph Beaman	DZB, Energy Coord.
Ira S. Rackley	A-E, Chilton Engineering
Sheldon S. Gordon	A-E, Chilton Engineering
Shigeru Fujitani	CofE, Sacramento District

The purpose of the conference was to establish and clarify the General and Detailed Scopes of Work required to prepare a Basewide Energy Systems Plan (BESP) for Hawthorne Army Ammunition Plant.

2. An undated Draft Scope of Work (SOW) was introduced for discussion by the Sacramento District (SPK) representative. The following actions were explained:

a. The Draft is to be revised to reflect all of the comments generated during the Clarification Conference. The final SOW is to be distributed and will represent the basic items for negotiations.

b. The SOW includes a General SOW which is comprehensive in nature addressing all increments of work and is typical for all energy studies in the Energy Engineering Analysis Program (EEAP). The Detailed SOW (Appendix A) will be developed specifically for HWAAP as a result of the Scope Clarification Conference.

c. Appendix B to the SOW is a list of reference documents. All documents will be made available to the A-E including the documents to be provided by the installation.

3. The attendees were provided advance copies of the Draft SOW to become familiar with the intended scope prior to the conference. This procedure eliminated the need to cover the SOW word for word and reduced the number of questions and/or comments. The following are comments generated during the ensuing discussions on the General Scope of Work:

a. The BESP for HWAAP will address only Increments A, B and G. The remaining increments will be treated as Supplemental Scopes of Work when they are authorized.

b. It was clarified that not all points discussed in paragraph 4.1 are to be addressed at this time and that the paragraph is a general discussion of all

increments of the BESP. Discussions at this point in time are informational in nature and will be covered to a greater depth in ensuing paragraphs of the SOW.

c. Para 4.1.7: Geothermal appears to be an excellent candidate for an alternative energy source. Several studies are being conducted in the region of HWAAP, one of which is under contract to Chilton Engineering. Another is being handled through the University of Nevada, Reno, for the Nevada Bureau of Mines and Geology. It was recommended that although this topic is beyond the intended scope of work, the A-E would not be out of line in mentioning the geothermal possibilities since he has done some research already.

d. Para 4.1.9: The primary energy source for HWAAP is electricity with propane service to the housing area and fuel oil #2 to the boiler plants.

e. Para 4.1.10: The heating distribution media is steam from the oil-fired boiler plants. It was pointed out that the heating plant for the demineralization plant currently under construction by the Navy located south of Walker Lake was grossly over-designed and that the coal-fired plant could provide more than enough steam to service HWAAP. The A-E will investigate the cost effectiveness and feasibility of such a concept.

f. Para 4.1.11: In accordance with HNDED-PM Trip Report on GOCO (Government Owned-Contractor Operated) Operations at a meeting on FY-80 EEAP for DARCOM installations, para 6.c.(4), the anticipated plant operations for the next 25 years "will be considered as a mirror image of the past 25." Mr. Justus stated that records for the past 25 years are available. Although the current population of HWAAP is around 500, future expansion would increase that number 3 and 4 fold. But, it was indicated that at one time HWAAP accommodated 2,000 people and the only facilities requiring replacement would be some family housing, the substandard housing at Babbitt for which paperwork has been submitted through channels to declare them surplus (demolition). No attempt will be made to upgrade the remaining structures at Babbitt.

g. Para 4.2.1.3: There is no planned physical plant expansion. There are no heat pump systems on the installation. There are production processes located in the production area but they are inactive at this time. The A-E will examine methods of furnishing support to a process, but not analyze the production process.

h. Para 4.2.2.1: The collection, treatment and storage of water is by surface runoff into reservoirs and storage tanks with chlorination as the only treatment. What little well water used is as backup for irrigation. Hot well #1 (140°F) has its water pumped to a cooling tower and then into a reservoir. The sewage from the housing and administrative areas is handled by an Imhoff tank and settlement ponds while septic tanks and leach fields are used in the production area.

i. A question was raised at this time regarding the A-E's investigation of "laid-away" buildings, specifically, the "moth balled" utility systems. Subsequent coordination with Huntsville Division (Energy Engineering Analysis

SPKED-M

RD/cm
4 January 1983

SUPPLEMENTAL SCOPE OF WORK

CONTRACT NO.: DACA05-81-C-0122

A-E: CHILTON ENGINEERING, CHARTERED

1. Installation and Location: Hawthorne Army Ammunition Plant, Hawthorne, NV
2. Subject: Energy Engineering Analysis Program (EEAP),
3. Authorization: HNDED-PM letter dated 28 September 1982, subject: EEAP.
4. Description of work and services required: Implement new Energy Conservation Investment Program (ECIP) Guidance dated revised 6 August 1982 (see Inclosure 1). Listed below are the Scopes of Work and corresponding paragraphs that are affected. The revised paragraphs are included here in their entirety, and supercede all previous writings.
 - a. Supplemental Scope of Work (SSOW) dated 21 January 1982 which includes the Scope of Work for Increments A, B, & G dated revised 8 January 1982.
 - 1.) Paragraph 4.1.2, The A-E shall develop improvement projects that will reduce the energy consumption in compliance with the Army Facilities Energy Plan. All projects recommended will be ranked in order of highest savings investment ratio (SIR). The SIR must be equal to or greater than 1. ECIP projects must amortize within and have a payback period of less than their economic life. Projects which will disrupt the occupancy of a facility shall be grouped together and performed at the same time, if practical.
 - 2.) Paragraph 4.1.7 The "Energy Conservation Investment Program (ECIP) Guidance," DAEN-MPO-U, 10 August 1982, establishes criteria for ECIP projects and shall be used for performing economic analyses, except as noted below. Engineer Technical Letter (ETL) 1110-3-332, DAEN-MPE-D, 22 March 1982, Part I or Part II, shall be used for evaluations where specified herein. Construction cost escalation for DD Form 1391 submission shall be calculated using Table 4 of AR 415-17. The technological updating factor applies to energy conservation projects (category code 82500) has been increased to 1.10. Additional guidance is contained in the latest applicable edition of the Engineer Improvement Recommendation System (EIRS) bulletin. The construction cost of ECIP projects must be equal to or greater than \$1000,000. Assume all improvement projects will be awarded in FY-86 (mid-point of construction about mid-point of FY-87, BOD about end of FY-87).

Revised 02 March 1983

- 3.) Paragraph 4.2.2.4.6. Labor savings/monitoring shall be included, provided the SIR is not affected to the extent of jeopardizing the ECIP requirements.
 - 4.) Paragraph 4.2.7.1. Identification of Increment G projects for energy conservation will be accomplished during Phases I and II of Increments A and B. All projects including low cost items shall be documented based on energy savings, dollar savings, SIR, man-hours to accomplish project and estimated cost. Projects will be listed in order of highest SIR.
 - 5.) Paragraph 4.3.2. Phase II shall consist of analysis of data, performance of feasibility and economic studies, identification of proposed projects and preparation of first page of DD Forms 1391. During this phase, all potential energy conservation measures which produce energy and/or dollar savings shall be identified and evaluated as to technical and economic feasibility. Energy conservation measures determined to be technically and economically feasible shall be combined into projects and ranked where required according to highest SIR. All simple and readily justifiable ECIP projects shall be submitted as early as possible, with programming documents (DD Forms 1391 and PDBs).
 - 6.) Paragraph 4.3.2.1.g. An ECIP Economic Analysis Summary as shown in the ECIP Guidance is to be provided for the complete project and for each type of retrofit action included in the project. The SIR is applicable to all segments of the project. Supporting documentation consisting of basic engineering and economic calculation showing how savings were determined will be included in the submittal.
 - 7.) Paragraph 4.3.2.1.h. The DD Form 1391 face sheet should include, for the complete project, the annual dollar and MBTU savings, SIR, and a statement attesting that all buildings and retrofit actions will be in active use throughout the amortization period.
 - 8.) The A-E shall revise the previously submitted Volume III (DD forms 1391 and PDB-Is) and PDB-II's for ECIP projects to reflect the new SIR economics. The A-E shall also submit appropriate revised pages for the Executive Summary to reflect these changes.
- b. SSOW dated 8 January 1982 which includes the Scope of Work for Increment F.
- 1.) Paragraph 4.2.6.10. The A-E shall summarize all cost, man-hours, dollar savings and energy savings for modifications in this increment. They shall be listed in order from highest to lowest SIR.
 - 2.) Paragraph 4.2.6.12. The A-E shall also list all projects in Increment A, B, and G from highest to lowest SIR.

- 3.) The A-E shall submit revised tables for these projects to show prioritization by the SIR. He shall also submit Economic Analysis Summary Sheets for all of the Increment F projects. The A-E shall also submit revised pages for the Executive Summary to reflect these revisions to Increment F.
- c. SSOW dated revised 29 June 1982 which includes the Scope of Work for Increment C.
- 1.) The reference to ECIP criteria in paragraph 4.2.3.3.1.1. and 4.2.3.3.1. refers to the revised guidance dated 6 August 1982. The reference in this paragraph to ETL 1110-3-332 should read ETL 1110-3-332, Part II, paragraph 3.
- 2.) Paragraph 4.2.3.2.1.e. Identify the type of biomass fuels available and the type or process which would be economical for use on the installation. Wood chips, sawdust, pellets and any other locally available forms shall be considered. Transportation, processing storage and mission requirements must be considered in the evaluation. The evaluation shall be based upon ETL 1110-3-332, Part II, paragraph 2.
- 3.) Paragraph 4.2.3.4. Other Renewable Energy Sources. List and briefly describe each renewable energy source available to the installation. If there is a promising application of the identified renewable energy source, the A-E shall make a recommendation for a detailed study. If a detailed study is performed, evaluation shall be based upon ETL 1110-3-332, Part II, paragraph 2.
- d. Period of Service: The A-E shall submit fifteen (15) copies of the revised documents for review thirty (30) calendar days from date of notice to proceed for this modification. A-E shall submit originals plus fifteen (15) copies of the final documents twenty-one (21) calendar days from receipt of review comments on the draft submittal.
- e. All other paragraphs of the above referenced Scopes of Work remain unchanged.
- f. To summarize, the basic change in the ECIP criteria is a shift from using an energy to cost ratio to a savings to investment ratio for qualification and prioritization of projects developed in the EEAP. A computer program is provided in the new guidance which can be used to perform the required economic analysis calculations. Life cycle cost procedures are now based on ETL 1110-3-332 dated 22 March 1982. (SEE INCL 2)

Randy Redeem
Randy Redeem
PROJECT MANAGER

DISTRIBUTION:

A-E, Chilton Engineering, Chartered
Mil Des Br., A-E Nego
Mil Des Br., Tech Rev
Mil Des Br., FESS (Redeen) (Original)

SUPPLEMENTAL SCOPE OF WORK

CONTRACT NO.: DACA05-81-C-0122

A-E: Chilton Engineering, Inc.

1. Installation and Location: Hawthorne Army Ammunition Plant, Hawthorne Nevada.
2. Subject: Energy Engineering Analysis Program (EEAP) - Increment C, a part of the Basewide Energy Systems Plan, Hawthorne Army Ammunition Plant.
3. Authorization: Message P 051417Z Feb 82 from CDRUSAEDH Huntsville, AL //HNDED-PM//.
4. Description of Work and Services Required:

A. The A-E shall include the following paragraphs as an integral part of the scope of work for the subject project dated Revised 8 January 1982. The paragraph numbers associated with the Increment C described below relate to the paragraph numbers in the General Scope of Work previously supplied.

4.2.3 Increment C projects involve renewable energy projects. These studies are to determine the feasibility of utilizing renewable energy sources for space heating, space cooling, domestic hot water or process heat, or combinations thereof. Renewable energy sources include such items as biomass, hydro, wind, solar, tide, and wave propagation. Refuse incineration is considered to be a renewable energy source, but is not included in this increment. Geothermal and nuclear sources, although not strictly renewable energy sources, shall be considered among the alternatives. Programming documents are required (DD Forms 1391 and PDBs) for feasible projects.

4.2.3.1 Survey of potential usage of solar systems shall be made in conjunction with the energy requirements for various building types for the winter, spring, summer and fall season. Solar systems to be considered are those which have been installed and proven elsewhere and for which some operating and maintenance experience has been obtained. These systems include solar heated domestic hot water (preheating or full heating kitchen supply up to 180 degrees F and other domestic hot water at 100 degrees F), solar assisted heat pumps, solar collector/storage systems for space heating and cooling, and solar steam generation for process heat. Study will be limited to evaluating those concepts which A-E reasonably expects will result in economically justifiable projects. Generalized discussion of all possible solar systems is unnecessary.

4.2.3.1.1 Concepts shall be developed and evaluated for a minimum of two typical installations for specific building types at the facilities. The concept shall be based on solar collectors being located at the particular building where the collected energy will be used. The availability of mounting space for the solar collectors shall be studied and the location of each collector field shall be specified for each concept.

4.2.3.1.2 Each proposed solar collector installation shall be evaluated in accordance with ECIP criteria. If the proposed installation does not qualify under ECIP, it shall be evaluated in accordance with life cycle costing procedures and Engineer Technical Letter 1110-3-332, dated 22 March 1982, and payback periods with and without maintenance costs will be determined. Credit for operation and maintenance cost savings shall be given to any solar system if the system would be capable of supplying all thermal energy requirements for an area during the summer season so that a boiler plant could be shut down and the distribution system deactivated. Operating and maintenance costs and expected life of the installation shall be determined for each system based on experience of similar existing systems. Equipment, material and installation costs for each solar system shall be estimated.

4.2.3.1.3 The A-E shall investigate in detail those solar applications previously recommended in Increments A and B. The buildings and possible applications are as follows:

<u>Building No.</u>	<u>Potential Application</u>
A396	Domestic Hot Water (DHW)
	Space Heat
A4	DHW
A38	DHW
	Pool Heat
103-39	DHW for Showers
101-40	DHW for Showers
108-22	DHW for Showers
Family Housing	DHW

4.2.3.1.4 Impact of solar systems on the basewide energy usage shall be studied, based on the installation of solar systems having a range of payback periods, all to be less than the projected useful life of the facility served.

4.2.3.2 Biomass fuel potential and projects shall be studied in two phases.

4.2.3.2.1 The first phase shall be an assessment study of the potential and economic feasibility of using biomass fuel. The data on existing and projected thermal loads developed in Increments A and B shall be used in this phase. This phase shall include the following:

- a. Provide an assessment of on-base and surrounding forest potential for energy production.
- b. Determine the quantity of fuel that could be provided from Army forests under present management procedures. In addition, provide management techniques which could improve energy production on existing forest land.
- c. Determine the annual average energy production that could be available by the use of only waste materials from standard timber sales and unmerchantable timber.
- d. The economic feasibility of using biomass based on existing and projected thermal loads of the installation.

e. Identify the type of biomass fuels available and the type or process which would be economical for use on the installation. Wood chips, sawdust, pellets and any other locally available forms shall be considered. Transportation, processing storage and mission requirements must be considered in the evaluation. The economic analysis shall be based upon the life cycle costing procedures.

4.2.3.2.2 The second phase shall be performed only if the assessment study in the first phase indicates economic feasibility of using biomass fuels. The second phase shall be a detailed analysis of the application of biomass fuels and include the technical details of economically feasible projects.

4.2.3.3 Geothermal projects shall be assessed as follows:

4.2.3.3.1 Industrial Area (including Family Housing)

4.2.3.3.1.1 Identify the type of geothermal resource available (steam, hot water, hot water under pressure, etc.)

4.2.3.3.1.2 Provide an assessment of the geothermal potential for use in building space conditioning, domestic hot water production, processes and energy production. Air and water pollution consequences associated with the various applications shall be assessed and abatement measures recommended. A-E shall recommend necessary environmental studies required. A-E shall evaluate and state any institutional or legal barriers to the accomplishment or completion of a geothermal project.

4.2.3.3.1.3 Determine the economic feasibility of using geothermal for the applications described above. The economic analysis shall be based upon the Energy Conservation Investment Program guidance. Determine the quantity of fuel oil displaced. Credit for operations and maintenance cost savings for associated boiler plant shutdown and distribution system deactivation shall be given. Determine the energy consumed in the operation of the geothermal facility. Geothermal resource information for economic analysis will be based on information contained in report prepared by Nevada Bureau of Mines and Geology entitled "Low-to-Moderate Temperature Geothermal Resource Assessment for Nevada, Area Specific Studies" unless Option 1 or Option 2 of this supplemental scope of work is exercised.

4.2.3.3.1.4 Prepare DD Forms 1391 including 18 paragraph justification and PDB's I and II for feasible projects. For the facilities requirements sketch required by the PDB format, provide system description sketches. (One-line type diagrams).

4.2.3.3.1.5 Option 1: To improve definition of geothermal resource available provide the following: Modify existing well in section 29 drilled by Division of Earth Sciences in April, 1981, to an observation well by cementing off the cooler water below 600 feet and fracturing the existing casing between 600 feet and 480 feet. Assume the Army demolition personnel

will not be available to perform the fracturing. Develop a new six inch diameter cased well to 600 feet with mill-slot perforations the bottom 120 feet. Perform a ten day pump test to determine the coefficient of storage and coefficient of transmissibility of the aquifer. Provide a test report including data interpretation. A-E shall provide a qualified geologist to oversee the cementing and perforation of the existing well, select drilling site for new 600 foot test well, collect samples of drill cuttings at 10 foot intervals, analyze cuttings and prepare lithological log, oversee pump test, collect water samples once every 24 hours during pump test for chemical analyses, interpret the results of the chemical analyses, log downhole temperature gradients, monitor mud flow temperatures, and to prepare a report containing the above specified information. The A-E shall also provide a qualified hydrologist to prepare an interpretation of the pump test data and prepare a report with recommendations on this phase of the work. The A-E shall provide a qualified archaeologist to complete the drill site walk over requirements and prepare any required reports. The A-E shall be responsible for informing the installation of any required permits or licenses to accomplish the work described in this option, but it shall be the responsibility of the installation to procure said permits.

4.2.3.3.1.6 Option 2: To improve definition of geothermal resource available provide the following: Modify existing well in section 29 to an observation well as described in Option 1 above. Develop a new ten inch diameter cased well; completion information (advisory only) 14 3/4 inch hole to 50 feet, 12 3/4 inch hole 50 to 600 feet, mill-slot casing 480-600 feet, blank ten inch casing 0-480 feet, gravel packed 50-600 feet, cement seal 0-50 feet. Perform a thirty day pump test to determine coefficient of storage and coefficient of transmissibility of the aquifer. Provide a test report including data interpretation. A-E shall provide a qualified geologist to oversee the cementing and perforation of the existing well, select drilling site for new 600 foot test well, collect samples of drill cuttings at 10 foot intervals, analyze cuttings and prepare lithological log, oversee pump test, collect water samples for chemical analyses, interpret the results of the chemical analyses, log downhole temperature gradients, and to prepare a report containing the above specified information. The A-E shall also provide a qualified hydrologist to prepare an interpretation of the pump test data and prepare a report with recommendations on this phase of the work. The A-E shall provide a qualified archaeologist to complete the drill site walk over requirements and prepare any required reports. The A-E shall be responsible for informing the installation of any required permits or licenses to accomplish the work described in this option, but it shall be the responsibility of the installation to procure said permits.

4.2.3.3.2 Ordnance area (Option 3) - provide geothermal resource assessment as follows:

4.2.3.3.2.1 Resource assessment area for Option 3 shall be determined by location of potential boiler plants and distribution systems to be displaced vs. potential geothermal resource location and its associated distribution system. The boundaries of this resource assessment area shall be based on a preliminary determination of the economic limits of geothermal pipeline length (not to exceed a 3 square mile area). A-E shall provide preliminary economic analysis data assuming successful location of a geothermal source

within this limit (3 square miles) and his recommendations for continuing/discontinuing the assessment based on this data.

(Option 3a): The following work described by paragraphs 4.2.3.3.2.2 thru 4.2.3.3.2.4 will be done only if the results from the preliminary economic analysis justify further study.

4.2.3.3.2.2 Perform geochemical sampling and field geological observations.

4.2.3.3.2.3 Perform a 60 station two-meter temperature probe survey.

4.2.3.3.2.4 Drill nine- 120 foot gradient holes.

4.2.3.3.2.5 A-E shall provide a qualified geologist to perform/oversee the work described in the previous three paragraphs. A report shall be prepared for the above described work including interpretation of results and recommendations for continuing/discontinuing this study. The A-E shall be responsible for informing the installation of any required permits or licenses to accomplish the work described above, but it shall be the responsibility of the installation to procure said permits.

(Option 3b): The following work described by paragraphs 4.2.3.3.2.6 thru 4.2.3.3.2.8 will be done only if the results from the preliminary reconnaissance work described above justify further study.

4.2.3.3.2.6 Drill up to 1000 feet (footage contract) of reservoir confirmation wells, blind cased or mill slot perforated, based on gradient hole information. The well shall be oversized to accommodate a 6 inch diameter casing with mill slots (200 feet total) and a 1 inch diameter blind cased tube (temperature gradients) adjacent to the 6 inch casing.

4.2.3.3.2.7 Perform ten day pump test as described in Option 1 above on the reservoir confirmation well.

4.2.3.3.2.8 The A-E shall provide a qualified geologist to select the drilling site for the reservoir confirmation well/s, collect samples of drill cuttings at 10 foot intervals, analyze cuttings and prepare lithological log, oversee pump test, collect water samples for chemical analysis log downhole temperature gradients, and prepare a report containing the above specified information. The A-E shall also provide a qualified hydrologist to prepare an interpretation of the pump test data and prepare a report with recommendations on this phase of the work. The A-E shall provide a qualified archaeologist to complete the drill site walk over requirements and prepare any required reports. The A-E shall be responsible for informing the installation of any required permits or licenses to accomplish the work described above, but it shall be the responsibility of the installation to procure said permits.

4.2.3.3.3 Impact of geothermal systems on the basewide energy usage shall be studied. The geothermal systems selected shall have payback periods less than the projected useful life of the facilities served.

4.2.3.4 Other Renewable Energy Sources. List and briefly describe each renewable energy source available to the installation. If there is a promising application of the identified renewable energy source, the A-E shall make a recommendation for a detailed study.

B. The A-E shall modify the Executive Summary prepared for Increments A, B, F, & G to include a summary of Increment C highlights.

5. Reference Documents:

- a. Scope of Work for the subject project dated revised 8 January 1982.
- b. Interim submittal just completed by Chilton Engineering for Increments A, B, F & G of the EEAP for Hawthorne AAP.
- c. Nevada Bureau of Mines and Geology Final Report dated August 30, 1981, titled "Low-to-Moderate Temperature Geothermal Resource Assessment for Nevada, Area Specified Studies".
- d. Conference minutes dated subject: Energy Engineering Analysis Program - Increment C, Hawthorne AAP, Hawthorne, Nevada.

6. Submittals and Periods of Service:

- a. If none of the options are awarded, the draft submittal shall be due 60 calendar days from the date of notice to proceed, and the final submittal including revised executive summary shall be due 30 calendar days from date of receipt of draft review comments.
- b. If Option 1 is awarded the draft submittal shall be due 120 calendar days from the date of notice to proceed, and the final submittal including revised executive summary shall be due 30 calendar days from date of receipt of draft review comments.
- c. If Option 2 is awarded the draft submittal shall be due 150 calendar days from the date of notice to proceed, and the final submittal including revised executive summary shall be due 45 calendar days from date of receipt of draft review comments.
- d. If Option 3 is awarded the draft submittal shall be due 180 calendar days from the date of notice to proceed and the final submittal shall be due 45 calendar days from date of receipt of draft review comments.
- e. The draft submittals described above shall include cover sheet DD Form 1391's only with sufficient back-up data to substantiate the projects. The final submittal will include complete programming documents for approved projects.

f. Number of copies shall be as follows:

(1) Draft - 10 copies

(2) Final - 15 copies

7. Points of Contact:

a. Sacramento District: Facilities Engineering Support Section,
Randy Redeen, (916) 44-2874, FTS 448-2874.

b. Hawthorne Army Ammunition Plant: Chief Engineer, Floyd L. Justus,
(707) 945-7020.

8. Miscellaneous Instructions:

a. All reproduction shall be the A-E's responsibility.

b. The A-E is cautioned to take no guidance during the course of the work from any other source except the Sacramento District representative. This does not preclude him from coordinating with installation facilities engineering personnel.

c. There is some obvious overlap in regards to solar and geothermal applications. The A-E shall decide which method (solar vs. geothermal) is best suited for the application and give reasons for his decision including all necessary back-up data, calculations, etc..


RANDY REDEEN
Project Manager

DISTRIBUTION

A-E, Chilton Engineering, Inc.
FE, Hawthorne Army Ammunition Plant, ATTN: SARHW-FW
USAED Huntsville, ATTN: HNDED-PM (Ganus)
DARCOM, ATTN: DRCIS-RI-IU
AARCOM, ATTN: DRSAR-ISF-O
USAMPBMA, ATTN: SARPM-PBM-EC
CERL, ATTN: CERL-ES (Richard Singer)
D.O.E., Idaho Operations Office, ATTN: Jack Ransthaller
Mil Des Br, A-E Nego
Mil Des Br, Tech Rev
Mil Des Br, FESS (Redeen) (Orig)

SUPPLEMENTAL SCOPE OF WORK

CONTRACT NO.: DACA05-81-0122

A-E: Chilton Engineering, Inc.

1. Installation and Location: Hawthorne Army Ammunition Plant, Hawthorne, NV.
2. Subject: Energy Engineering Analysis Program (EEAP) - Increment E, a part of the Basewide Energy Systems Plan, Hawthorne Army Ammunition Plant, Hawthorne, Nevada.
3. Authorization: HNDED-PM letter dated 21 April 1982, subject: FY83 Energy Engineering Analysis Program (EEAP).
4. Description of Work and Service Required:

A. The A-E shall include the following paragraphs as an integral part of the Scope of Work for subject project dated Revised 8 January 1982. The paragraph numbers associated with Increment E described below relate to the paragraph numbers in the General Scope of Work previously supplied.

4.2.5 Increment E - Central Boiler Plant Projects: Determine the feasibility of installing central boiler plants serving all or discrete parts of each military installation. If the information gathered at the initial site investigation indicates that further centralization of existing plants is impractical, the A-E shall notify the Contracting Officer that central plant analysis does not appear feasible and submit supporting information. If the Contracting Officer agrees that a central plant study is not feasible after reviewing the information, an engineering report and economic analysis of converting the existing central plant of plants to solid fuels shall be prepared instead of a central plant analysis. Programming documents are not required (DD Forms 1391 and PDBs).

4.2.5.1 A study shall be made to determine the practicability and economic feasibility of constructing central boiler plants to supply steam or high temperature water, as applicable, to all or discrete parts of each military installation. The study shall evaluate, including economic analysis, a single boiler plant serving the entire facility. If there are probable advantages to multiple plants or single plant serving a discrete part of the facility, these concepts shall be analyzed as alternates to a single plant concept. A primary objective is to reduce the dependency on petroleum fuels by changing to coal or other solid fuels as the primary fuel with oil as the backup or secondary fuel. The use of solid fuel such as biomass, RDF and wood as a fuel or as a fuel or as a supplemental fuel to coal shall be considered. Existing distribution and building systems shall be utilized to the maximum practical extent, but the analysis shall include new distribution systems or additional sections where required. The study shall assume that all practical energy conservation measures developed by the Basewide Energy Study would have been accomplished except for cogeneration and solid waste plants. The study shall include site recommendations and shall consider sources of refuse derived fuels, biomass, wood, and coal supply, transportation methods, fuel handling and storage and pollution control methods.

4.2.5.2 Economic Analysis shall be based on life cycle costing procedures. Any savings or increase in energy consumption shall be documented. The condition and life expectancy of existing central boiler plants shall be considered and documented. The report shall contain sufficient data and present the information so as to permit the installation to easily produce these programming documents, if so desired, by extracting technical and economic data and updating the economic evaluations.

4.2.5.3 The study methodology used to evaluate the feasibility of constructing central boiler plants to supply steam or high temperature water shall include the evaluation of distribution piping heat loss as an element of the energy benefits/penalties involved in the option being studied. The methodology to be used shall also evaluate the impact on overall boiler plant efficiency of consolidation of loads and improvements to the part load efficiency of the boiler plant resulting from this consolidation of plant loads.

4.2.5.4 Previous Studies/Increments. The A-E personnel performing work under this increment shall become thoroughly familiar with all other increments and previously conducted energy studies and surveys. The A-E shall make use of past or current HWAAP studies, surveys and feasibility reports as supplemental and support data for this increment study. The A-E shall verify that the information used from previous studies and increments are still valid and applicable to this increment.

4.2.5.5 Computer modeling shall be used for assimilation and analyzing each central boiler plant operation and associated heat transmission (steam/hot water distribution) system. The A-E shall use computer modeling to account for boiler plant load and heat distribution line losses, estimate plant energy consumption and evaluate plant operating efficiency under full and partial loads. The computer program used for modeling shall be DOE-2.1A or BLAST (Building Loads Analysis and Systems Thermodynamics) Program. The A-E shall submit a computer-run sample with an explanation summary of input/output data and program methodology.

B. The A-E shall modify the Executive Summary prepared for Increment A,B, C,D & F to include a summary of Increment E highlights.

5. Reference Documents:

- a. Scope of Work for subject project dated revised 8 January 1982.
- b. Interim submitted just completed by Chilton Engineering for Increments A,B,F & G of the EAAP for Hawthorne AAP.
- c. Conference Minutes dated 26 August 1982, subject: Energy Engineering Analysis Program-Increment E, Hawthorne AAP, Hawthorne, Nevada.

6. Submittal and Period of Service:

- a. The draft submittal and revised executive summary shall be due 60 calendar days from the date of notice to proceed.
- b. The final submittal for Increment E and revised executive summary shall be due 30 calendar days from date of receipt of draft review comments.

c. The times do not include review time by the Government nor transmittal time from A-E to the Project Manager.

d. Number of copies shall be as follows:

(1) Draft - 10 copies

(2) Final - 15 Copies

7. Points of Contact:

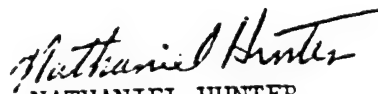
a. Sacramento District: Facilities Engineering Support Section,
Nathaniel Hunter, (916) 440-3507, FTS 448-3507.

b. Hawthorne Army Ammunition Plant: Chief Engineer, Floyd L. Justus,
(707) 945-7020.

8. Miscellaneous Instructions:

a. All reproduction shall be the A-E's responsibility.

b. The A-E is cautioned to take no guidance during the course of the work from any other source except the Sacramento District representative. This does not preclude him from coordinating with installation facilities engineering personnel.


NATHANIEL HUNTER
Project Manager

DISTRIBUTION:

A-E, Chilton Engineering
FE, Hawthorne AAP, ATTN: SARHW-FE
Mil Des Br, A-E Nego
Mil Des Br, Tech Rev
Mil Des Br, FESS (Hunter)(Orig)

SUPPLEMENTAL SCOPE OF WORK

SUBJECT: Energy Engineering Analysis Program, Hawthorne Army Ammunition Plant, Hawthorne, Nevada

CONTRACT NO.: DACA05-81-C-0122

A-E: Chilton Engineering

1. Installation and Location: Hawthorne Army Ammunition Plant, Hawthorne, Nevada.

2. Authorization: HNDED-PM letter, dated 7 July 1981, subject, FY 82 Energy Engineering Analysis Program (EEAP).

3. Description of Work and Services:

a. The A-E shall include the following paragraphs as an integral part of the Scope of Work for the subject project, dated revised 8 January 1982. The paragraph numbers associated with the Increment F described below relate to the paragraph numbers in the General Scope of Work previously supplied.

4.2.6 Increment F

4.2.6.1 The purpose of the work under this increment is:

a. To provide recommendations for modifications and changes in system operation which are within the Facilities Engineer funding authority and management control.

b. To summarize and prioritize all energy conservation measures and projects from Increments A, B, F, and G for the use of the Installation Commander and Facilities Engineer in developing their energy management plan.

4.2.6.2 Recommendations for Modifications. The intent is to provide these recommendations in the form of specific, practical instructions for the use of the Facilities Engineer personnel. For planning purposes, each recommendation shall include manhours, labor, and material costs to accomplish, and dollar and energy savings which it will produce.

4.2.6.3 Facilities Engineer Funding Authority. Only modifications which fall within the Facilities Engineer funding authority and management control shall be described in detail as outlined in paragraph 3.5.6.7. It is anticipated that most modifications will be relatively low cost and well under the Facilities Engineering funding approval limits which, in general terms, are \$100,000 for alteration type work and \$500,000 for maintenance and repair type work. If there are any individual work items which exceed these amounts, they shall only be listed, with a brief description.

4.2.6.4 Level of A-E Effort. The site surveys under this increment shall be performed by Senior Mechanical, Electrical, and Energy Conservation Engineers. There are a large number of buildings and systems to be examined

and it would be too costly and time consuming to do a detailed analysis of each. In order to make the maximum use of limited time, a great deal of experienced judgment must be employed to determine the required length and depth of analysis of each system.

4.2.6.5 Previous Studies/Increments. The A-E personnel performing work under this increment shall become thoroughly familiar with all other increments and any previous energy studies prior to commencing site work.

4.2.6.6 Buildings and Systems to be Surveyed. A site specific list of buildings and systems to be surveyed is appended to this scope.

4.2.6.7 The A-E shall describe all recommended energy conserving modifications to systems equipment or operations in the following format:

- a. Brief description of reasons for the modification.
- b. Specific instructions for accomplishing modifications.
- c. Estimated manhours and labor and material costs. Manhours to be listed by trade.
- d. Estimated dollar and energy savings.

4.2.6.8 At the conclusion of the site survey, the A-E shall prepare a rough draft of the recommended modifications and schedule a meeting to discuss them with the Facilities Engineer in order to obtain his input and advice.

4.2.6.9 The A-E shall list and date all energy conservation modifications accomplished by the installations since 1975.

4.2.6.10 The A-E shall summarize all costs, manhours, dollar savings, and energy savings for modifications in this increment. They shall be listed in order from highest to lowest E/C ratio.

4.2.6.11 The A-E shall check the installation master plan for all planned facilities changes, list them, and provide an energy use estimate for each. This estimate shall be based on average figures for that type of facility.

4.2.6.12 The A-E shall list all projects in Increments A, B, and G from highest to lowest E/C ratio.

4.2.6.13 The A-E shall describe any energy related areas of operation in which he determines additional training of Facilities Engineer personnel is required. The specific type of training shall be described. Specific Government or commercial courses shall be listed, with cost and duration, whenever possible. The A-E shall recommend only those commercial courses with which he is familiar. It is understood that it is the Government's responsibility to make a final determination as to the acceptability of the course. The A-E shall contact Huntsville Division Training Office (205) 895-5039 for information on Government furnished training. Training necessitated by recommended modifications shall be included.

4.2.6.14 The A-E shall describe expendable equipment which should be changed to a higher efficiency type at the next replacement. A specified detailed description for the use of the installation procurement office shall be furnished. The A-E shall provide three (3) manufacturers which meet the specifications for the equipment recommended.

4.2.6.15 Explanatory Notes:

a. General. Special attention should be directed towards electrical consumption. Opportunities to reduce it by means of load programmers, timers, programmable timers, reduction of constant volume air flow and conversion to variable volume air flow should not be overlooked.

b. Reference paragraph 4.2.6.3. Any specific questions concerning Facilities Engineer authority shall be directed to the Facilities Engineer during the site survey.

c. Reference paragraph 4.2.6.7 It is inevitable that some recommended modifications will already be known to the Facilities Engineer. These will be described by the A-E exactly as all others. This scope is intended to produce one comprehensive list, with backup data, based on energy considerations.

d. Reference paragraph 4.2.6.7 These modifications may ultimately be performed by Facilities Engineer or contract personnel. This does not affect the format described.

e. Reference paragraph 4.2.6.7 This serves as a check list of items which do not appear as recommended modifications because they have already been done.

f. Reference paragraphs 4.2.6.7 and 4.2.6.10. The summary of manhours by trade is intended to provide Facilities Engineer with backup information to determine staffing required to accomplish energy conservation.

g. Reference paragraphs 4.2.6.10, 4.2.6.11, and 4.2.6.12. The summaries of potential energy savings from Increments A, B, and G projects, Increment F modifications, and the energy impact of Master Plan changes is intended to show the Facilities Engineer and Installation Commander the possibilities available to meet energy reduction goals.

h. Heating and cooling power plants are to be included in this increment. There are undoubtedly some significant low cost modifications that can be made in these areas.

b. The A-E shall modify the Executive Summary prepared for Increments A, B, and G to include a summary of Increment F highlights (including the list of recommended modifications).

4. Reference Documents:

a. Scope of Work for the subject project dated 13 January 1981.

b. Conference Minutes, dated 6 January 1982, subject: Energy Engineering Analysis Program (EEAP), Increment F, Hawthorne Army Ammunition Plant, Hawthorne, Nevada.

c. Interim Submittal, EEAP, currently being prepared by Chilton Engineering.

d. Attached list of buildings to be surveyed specifically for Increment F.

5. Submittals:

a. The draft submittal and revised executive summary shall be due 120 calendar days from the date of notice to proceed.

b. The final submittal for Increment F and revised executive summary shall be due 21 calendar days from date of receipt of draft review comments.

c. The times do not include review time by the Government nor transmittal time from the A-E to the Project Manager.

7. Points of Contact:

a. Sacramento District: Facilities Engineering Support Section, Randy Redeen, (916) 440-2874, FTS 448-2874.

b. Hawthorne Army Ammunition Plant: Floyd L. Justus, Chief Engineer, (702) 945-7020.

8. Miscellaneous Instructions:

a. All reproduction shall be the A-E's responsibility.

b. The A-E is cautioned to take no guidance during the course of work from any other source except the Sacramento District representative. This does not preclude him from coordinating with installation Facilities Engineering personnel.

1 Incl
as

Randy Redeen
RANDY REDEEN
Project Manager

DISTRIBUTION:

A-E: Chilton Engineering
Mil Des Br, A-E Nego
Mil Des Br, Tech Rev
Mil Des Br, FESS (Redeen) (original)

APPENDIX D:
BUILDING MASTER LIST

HAWTHORNE AAP ENERGY AUDIT BUILDING MASTER LIST

BLDG. #	DUPL. #	TITLE	FLOOR AREA (sq. ft.)	STATUS *
BUILDING TYPE: OFFICE				
A1		Administration	6,552	A
A2		DZB Headquarters	7,920	A
A5		Corps Staff and USACC	12,370	A
A6		Personnel & I.S. Directorate	2,755	A
A9		Data Processing, Equip. Mgmt.	8,601	A
A37		Contract Security Office	14,493	A
A39		Facilities Engineering	8,601	A
C191		Housing Office	1,860	A
C194		General Purpose Administration	564	A
C195		Police Station	5,076	A
94		Fire Station & Safety Bldg.	4,857	A
95		Ordnance Administration Bldg.	5,776	I
97		Ordnance Test Field Office	5,776	A
101-30		101 Area Office & Chem. Lab.	2,448	A
102-51		Ordnance, Storage, QA & Supply Traffic Offices	24,356	A
103-28		Inspection Dept. (Gage Shop)	3,422	A
104-1		QA Underwater Ord. & Metrology	3,701	A
108-14		Surveillance Operations	6,102	A

* A= ACTIVE; I=INACTIVE ;L= LAIDAWAY D-2

HAWTHORNE AAP ENERGY AUDIT BUILDING MASTER LIST

BLDG.#	DUPL.#	TITLE	FLOOR AREA (sq. ft.)	STATUS*
BUILDING TYPE: WAREHOUSE/STORAGE				
A12		F.E.. Storehouse	1,593	A
A18		Roads & Grounds, Utilities Ofc.	2,304	A
A65		Supply & Servemart	23,472	A
A66		General Purpose Warehouse	23,472	A
B67		General Purpose Warehouse	23,400	A
B153		General Purpose Warehouse	12,087	I
C193		General Storage	10,400	A
93		Loading Dock #1	12,000	A
	134	Loading Dock #2	12,000	A
	135	Loading Dock #3	12,000	A
	136	Loading Dock #4	12,000	A
	137	Loading Dock #5	12,000	A
	138	Loading Dock #6	12,000	A
101-1		Cooling Shed #1	8,364	A
	101-6	Cooling Shed & Storage	8,364	A
	101-11	Cooling Shed (Plant #3)	8,364	A
101-12		Bulk TNT Storage Building	1,032	I
	101-2	Box Opening Plant #1	1,032	L (7/80)
	101-19	Bulk TNT Stor. & Box Opening	1,032	L (7/80)

HAWTHORNE AAP ENERGY AUDIT BUILDING MASTER LIST

BLDG. #	DUPL. #	TITLE	FLOOR AREA (sq. ft.)	STATUS *
BUILDING TYPE: WAREHOUSE/STORAGE (Continued)				
101-13		Box Opening Plant	722	I
	101-3	Box Opening Plant	722	L (7/80)
	101-10	Box Opening Plant	722	L (7/80)
	101-20	Box Opening Plant	722	L (7/80)
101-16		Cooling Shed Plant #4	19,360	A
103-7		Inert Loading Facility	10,251	A
	103-9	Case & Tank Storage	10,251	A
	103-11	Case Cleaning Building	10,251	A
108-13		Inhibiting Building	12,444	A
49SH8		Cold Battery Storage	10,251	A
110-27		Ordinance Tools & Equipment	8,211	A
110-28		Ordinance Tool Room	8,211	A
112-89		Controlled Humidity Warehouse	5,356	A
	112-90	Controlled Humidity Warehouse	5,356	A
116-20		Hi Explosive Mag	6,765	A

* A= ACTIVE; I=INACTIVE ;L= LAIDAWAY D-4

HAWTHORNE AAP ENERGY AUDIT BUILDING MASTER LIST

BLDG.#	DUPL.#	TITLE	FLOOR AREA (sq. ft.)	STATUS*
BUILDING TYPE: REPAIR/MAINTENANCE				
A7		F.E. Maintenance	12,272	A
A10		Machine Shop	11,040	A
A11		Locomotive Shop	6,450	A
A26		Paint Shop	5,775	A
A43		Electronic Maintenance	2,541	A
A46		Fiberglass & Compressor Bldg.	2,500	A
A63		Sheetmetal Shop	23,798	A
A64		Automotive Maintenance	22,628	A
A146		Carpenter Shop	10,251	A
150		Railroad Maintenance	5,992	A
101-24		Compressed Air Tank Plant	3,321	A
102-52		Auto Maintenance Shop	21,639	A

*A=ACTIVE; I=INACTIVE ;L=LAIDAWAY

HAWTHORNE AAP ENERGY AUDIT BUILDING MASTER LIST

BLDG.#	DUPL.#	TITLE	FLOOR AREA (sq. ft.)	STATUS*
BUILDING TYPE: PRODUCTION				
101-15		Filling Plant #3	1,656	I
	101-5	Filling Plant #1	1,656	L (7/80)
	101-7	Filling Plant #2	1,656	L (7/80)
	101-17	Filling Plant #4	1,656	L (7/80)
101-21		Case Prep Plants 1 & 2	20,301	A
101-22		Case Prep Plants 3 & 4	20,301	A
101-44		Drilling & Fusing Bldg.	12,500	A
101-48		Radiographic Facility	4,227	A
102-31		Ammunition Renovation	10,251	A
103-5		Case Filling Plant	12,342	I
103-8		Tank Overhaul	13,368	A
103-10		Case Overhaul	13,547	A
103-16		Projectile Overhaul	15,394	A
103-17		Grease Lab.	1,180	A
103-20		Box Repair	10,098	A
104-3		Mine Assembly	11,008	A
104-5		Mine Sub Assembly	20,349	A
104-8		Weapons Plant	10,629	A
104-14		Mine Mechanism Test Plant	6,426	A
108-3		Motor Assembly Tanking	10,000	A
108-20		Rocket Motor Assem. & Overhaul	46,278	I

*A=ACTIVE; I=INACTIVE ;L=LAIDAWAY

HAWTHORNE AAP ENERGY AUDIT BUILDING MASTER LIST

BLDG.#	DUPL.#	TITLE	FLOOR AREA (sq. ft.)	STATUS*
BUILDING TYPE: PRODUCTION (Continued)				
108-21		Ammunition Renovation	4,131	I
49SH10		Cavity Hot Melt Building	13,082	A

*A=ACTIVE; I=INACTIVE ;L=LAIDAWAY

HAWTHORNE AAP ENERGY AUDIT BUILDING MASTER LIST

BLDG.#	DUPL.#	TITLE	FLOOR AREA (sq. ft.)	STATUS*
BUILDING TYPE: HOUSING				
A35		8 Family Apartment	13,312	A
	A36	8 Family Apartment	13,312	A
A174		Family Housing	5,225	A
A178		Family Housing LC-MJ	3,152	A
	A175	Family Housing LC-MJ	3,152	A
	A176	Family Housing LC-MJ	3,152	A
	A177	Family Housing LC-MJ	3,152	A
	A179	Family Housing LC-MJ	3,152	A
A180		Family Housing CG-WO	2,247	A
	A181	Family Housing CG-WO	2,247	A
	A182	Family Housing CG-WO	2,247	A
	A183	Family Housing CG-WO	2,247	A
	A184	Family Housing CG-WO	2,247	A
	A185	Family Housing CG-WO	2,247	A
	A186	Family Housing CG-WO	2,247	A
	A187	Family Housing CG-WO	2,247	A
	A188	Family Housing CG-WO	2,247	A
	A189	Family Housing CG-WO	2,247	A
	A190	Family Housing CG-WO	2,247	A
	A279	Family Housing CG-WO	2,247	A
	A280	Family Housing CG-WO	2,247	A
	A281	Family Housing CG-WO	2,247	A

* A= ACTIVE; I= INACTIVE ; L= LAIDAWAY

HAWTHORNE AAP ENERGY AUDIT BUILDING MASTER LIST

BLDG.#	DUPL.#	TITLE	FLOOR AREA (sq. ft.)	STATUS*
BUILDING TYPE: HOUSING (Continued)				
A286	A282	Family Housing CG-WO	2,247	A
	A283	Family Housing CG-WO	2,247	A
		Family Housing CG-WO	2,307	A
	A284	Family Housing CG-WO	2,307	A
	A285	Family Housing CG-WO	2,307	A
	A287	Family Housing CG-WO	2,307	A
	A288	Family Housing CG-WO	3,157	A
	A289	Family Housing CG-WO	3,157	A
A290		Family Housing LC-MJ	2,320	A
	A291	Family Housing LC-MJ	2,320	A

HAWTHORNE AAP ENERGY AUDIT BUILDING MASTER LIST

BLDG. #	DUPL. #	TITLE	FLOOR AREA (sq. ft.)	STATUS *
BUILDING TYPE: MISCELLANEOUS				
		<u>RECREATION</u>		
A3		Community Club	7,857	A
A14		Theatre	3,440	A
A38		Gym & Swimming Pool	22,160	A
A47		Hobby Shop	15,580	A
A61		Golf Course Club House	2,392	A
C357		Bowling Center	10,938	A
		<u>LUNCH/SHOWERS</u>		
101-40		Women's Shower Room	3,280	A
103-39		Decontamination Facility	8,800	A
108-22		Decontamination Facility	8,240	I
275		Decontamination Facility	1,830	A
C66		Golf Course Lockers	1,485	A
		<u>MISCELLANEOUS</u>		
A4		E.M. Barracks W/Mess	17,101	A
A8		Fire Station	11,040	A
A42		Dispensary	12,217	A
A155		Post Exchange	8,800	A
A396		E.M. Barracks W/O Mess	8,820	A
70		Diesel Power Plant #1	5,292	A

* A= ACTIVE; I=INACTIVE ;L= LAIDAWAY D-10

HAWTHORNE AAP ENERGY AUDIT BUILDING MASTER LIST

BLDG. #	DUPL. #	TITLE	FLOOR AREA (sq. ft.)	STATUS*
BUILDING TYPE: MISCELLANEOUS (Continued)				
		<u>MISCELLANEOUS</u> (Continued)		
120		Sewage Treatment Plant	N/A	A
C661		Pump House-Well #6	N/A	A
	71	Pump House-Well #1	N/A	A
	72	Pump House-Well #2	N/A	A
	73	Pump House-Well #3	N/A	A
	74	Pump House-Well #4	N/A	A
	168	Pump House-Well #7	N/A	A
	170	Pump House-Well #8	N/A	A

HAWTHORNE AAP ENERGY AUDIT BUILDING MASTER LIST

BLDG. #	DUPL. #	TITLE	FLOOR AREA (sq. ft.)	STATUS *
BUILDING TYPE: UTILITIES AND ENERGY DISTRIBUTION SYSTEMS				
		<u>ENERGY PLANTS</u>		
A13		Boiler Plant	5,992	A
C429		Oil Heating Plant	N/A	A
101-42		Boiler House	2,151	A
103-6		Boiler House	6,259	A
103-31		Boiler House	1,738	A
104-2		Boiler House & Lunchroom	1,176	A
104-4		Boiler House & Lunchroom	3,009	A
101-25		Boiler House & Lunchroom	4,680	A
		<u>UTILITY SYSTEMS</u>		
STRLT		Exterior Lighting	N/A	A
1EXLT		Exterior Lighting	N/A	A
2EXLT		Exterior Lighting	N/A	A
3EXLT		Exterior Lighting	N/A	A
1TRAN		Substation	N/A	A
2TRAN		Substation	N/A	A
1CONL		Steam Condensate Lines	N/A	A
2CONL		Steam Condensate Lines	N/A	A
1STML		Steam Supply Lines	N/A	A
2STML		Steam Supply Lines	N/A	A
AIRDS		Compressed Air Line	N/A	A